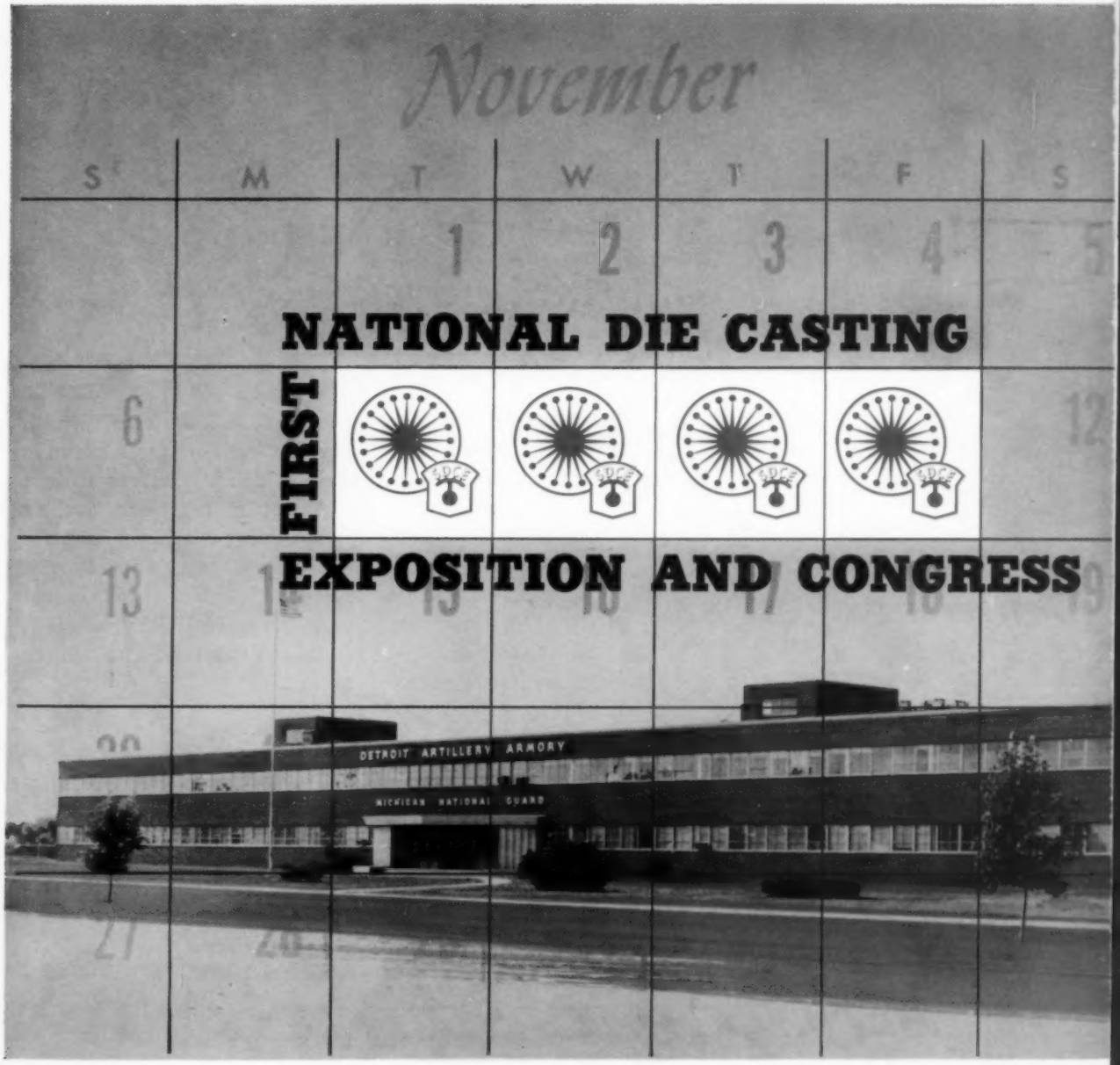
DIE CASTING ENGINEER

PUBLICATION OF THE SOCIETY OF DIE CASTING ENGINEERS / SEPTEMBER, 1960



● NEW SHOT END . . . . Page 9
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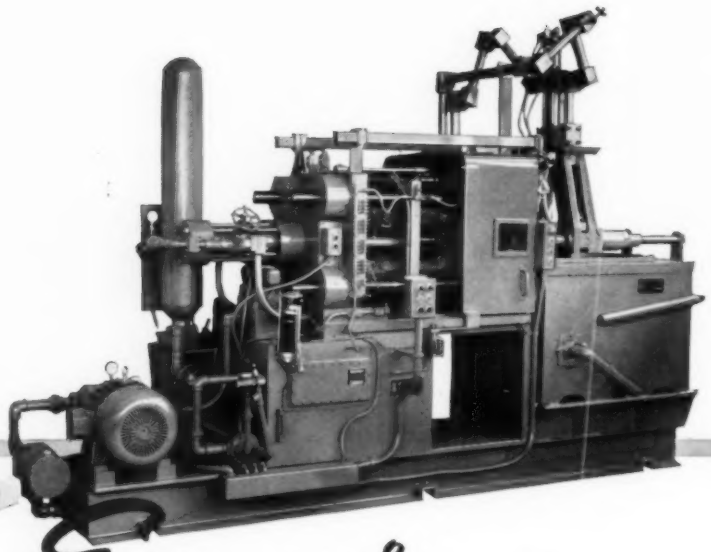

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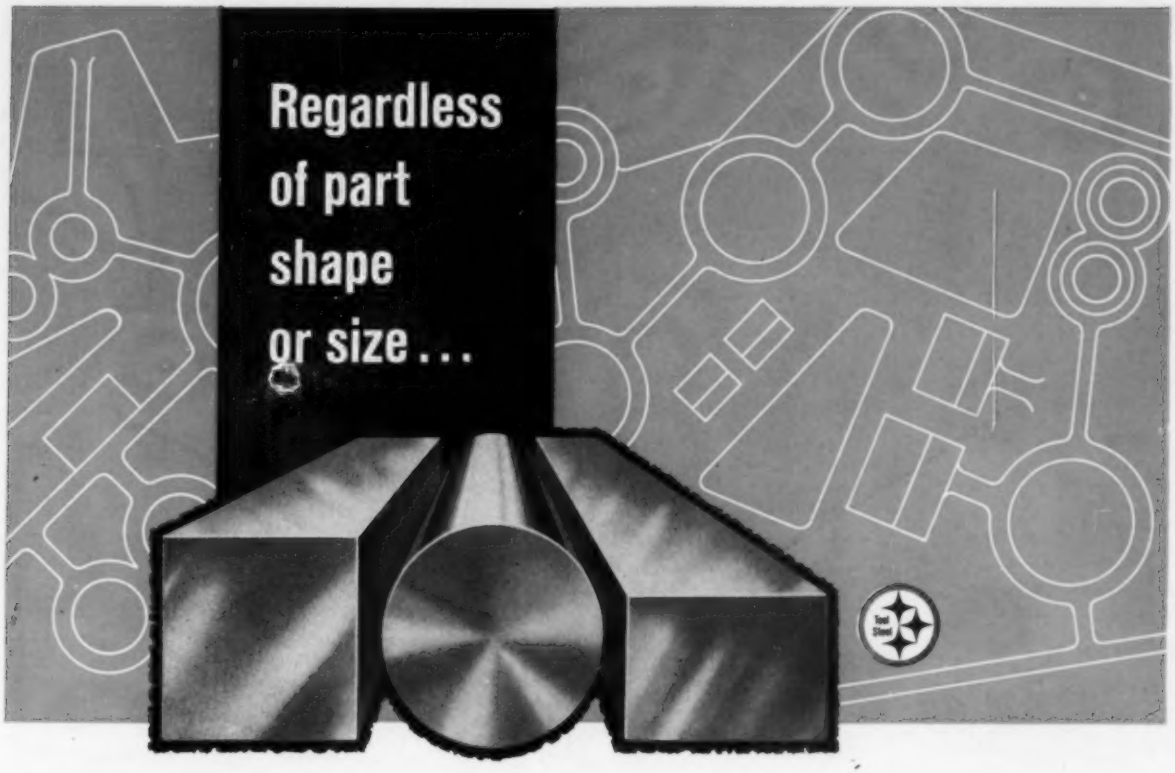

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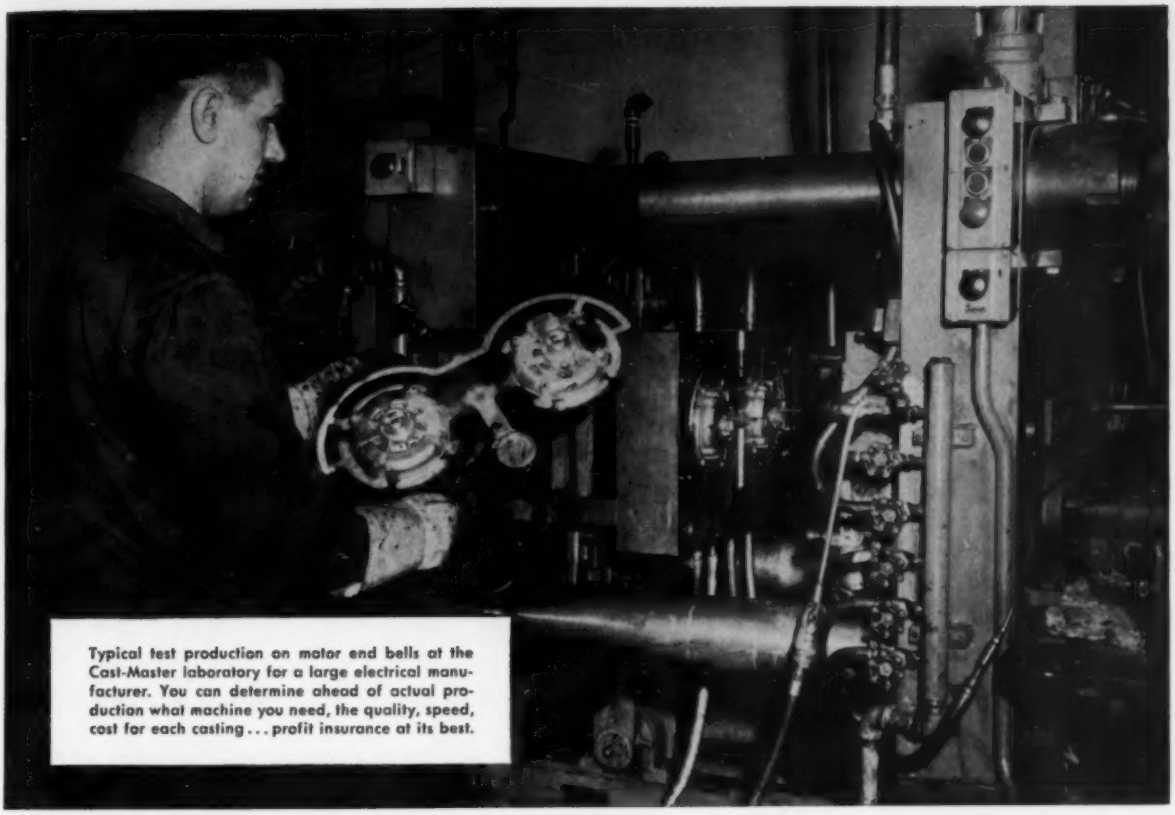

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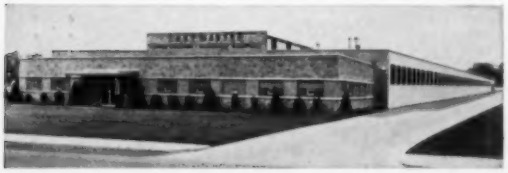

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DIE CASTING ENGINEER

Volume 4 ☆ Number 4 ☆ September, 1960

Official Publication of
THE SOCIETY OF DIE CASTING ENGINEERS, INC.

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The DIE CASTING ENGINEER is published bimonthly by The Society of Die Casting Engineers, Inc.—a society for the improvement and dissemination of the knowledge of the arts and sciences of die casting, the finishing of metals, and the allied arts. The DIE CASTING ENGINEER offers a concentrated coverage of management and engineering in the die casting and directly related industries.

The DIE CASTING ENGINEER is circulated without charge to all members of the SDCE and, upon request, to qualified engineering and management personnel engaged in die casting, metal finishing and the allied arts in the continental United States, including government and university personnel. Other subscriptions: Continental U.S., $6.50 per year; single copy, $1.75. Foreign countries, $8.00 per year.

The opinions expressed in signed articles and statements, are not necessarily those of the DIE CASTING ENGINEER.

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From the President's Office:

To acquaint more people with the Society of Die Casting Engineers, it's purpose, and it's functions, I will outline our various programs.

The Die Casting industry has been expanding at a rate much greater than the pace of educating and training personnel for efficient production. The S.D.C.E. has the fulfillment of this need as part of its purpose.

All Society policies and programs are established by a Board of Directors elected by the membership at large. The Directors are from all areas of the country and all phases of our industry. A history of the formation and structure of the S.D.C.E. will be published in the next issue of this magazine.

The technical programs at the local chapters' monthly meetings were established to disseminate knowledge. It is very true that a speaker, in approximately 45 minutes, cannot explain all the details of his subject. His primary purpose is to provide enough basic thought to cause people to think, thereby gaining knowledge of the subject. Chapter meetings also create a friendly atmosphere, which leads to discussions on common problems and hence the foundation of further technical advances.

The Exposition and Congress to be held in November was established with emphasis on the educational value of the exhibits and the Technical Congress. Elsewhere in this issue is a listing of the titles and authors of the papers to be presented at the Congress.

The officers of the Society are very pleased with the program, Harry Hall and Dave Sallatin are to be praised for their untiring efforts in making this program a reality.

During a discussion with a member at a recent chapter meeting, this member expressed his willingness and desire to be of service to the Society which is, in turn, aiding our industry, therefore making a contribution to the economic condition of our country. I am certain there are many members who have this attitude, the desire to have an active part in an organization which has as its purpose, IMPROVEMENT. This type of thinking indicates that the S.D.C.E. will continue its rapid growth and its ability to fulfil its purposes.

Respectfully yours,

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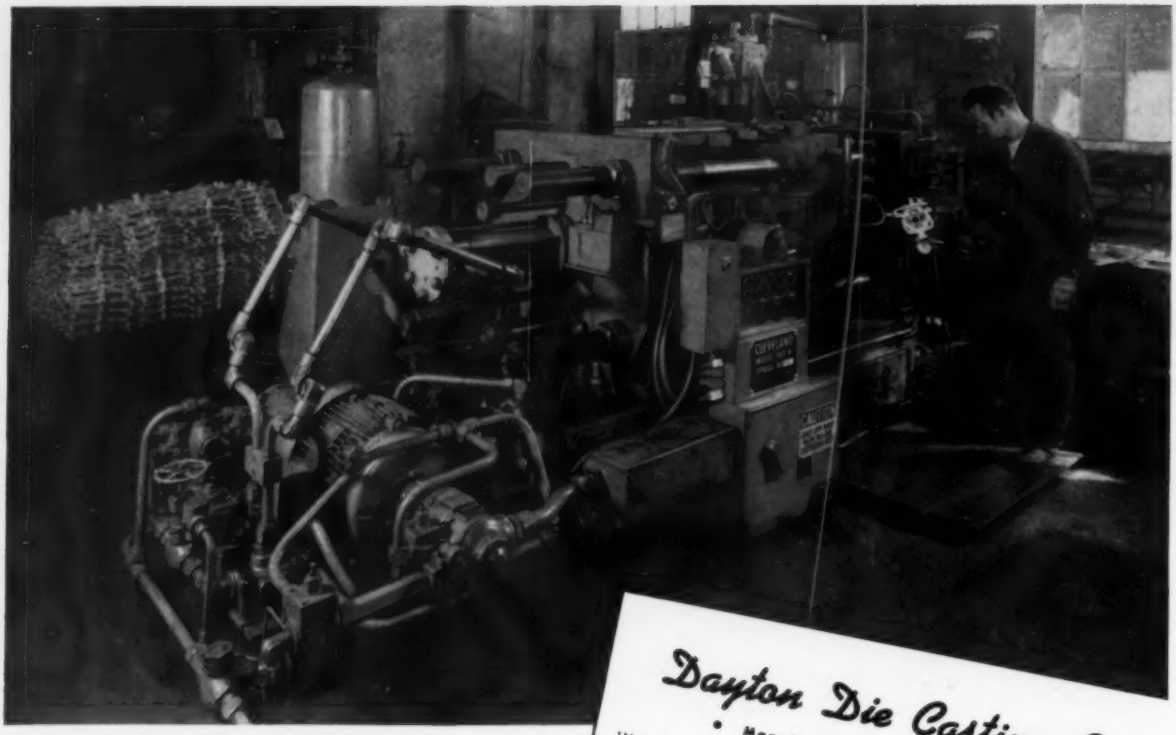

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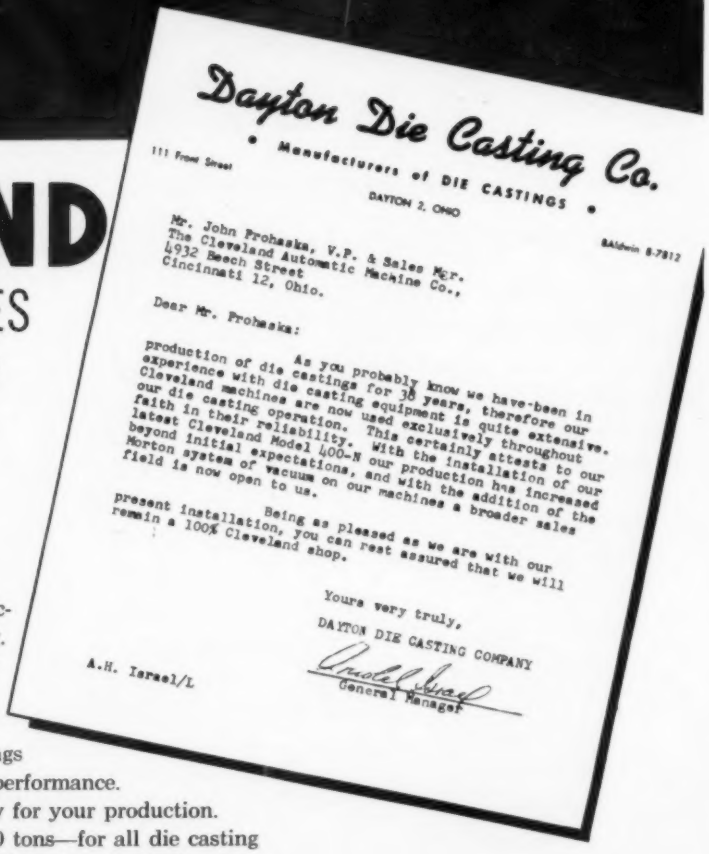

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Die Casting Machine Injection Systems

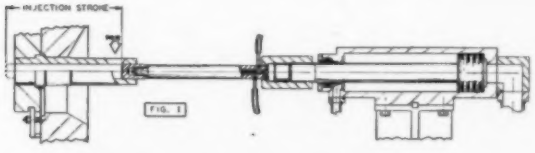
(Cold Chamber Type)

By HEINZ C. WERNECKE
Chief Design Engineer
Die Casting Division
Kiekhaefer Corporation

THIS ARTICLE DEALS WITH the problems encountered in the die casting of aluminum, brass, and magnesium. More specifically, it deals with the injection system which consists of the machine parts which inject the molten metal into the die. Since the injection system is really where the casting is born, it is important that it be designed and constructed to the highest degree of perfection. Two new types of systems are shown that will improve production, density and quality of castings.

Most die casting machines used for the casting of aluminum, brass, or magnesium use an injection system of the type shown in **Fig. 1.** This consists of a shot sleeve or magazine into which the metal is ladled through a "pour" hole. This sleeve extends into the die and is carried on the stationary platen of the machine. A register ring prevents lateral movement of the sleeve.

Into this shot sleeve is fitted a plunger tip that pushes the metal into the die cavity. To this tip is attached a plunger rod which contains the water cooling passages

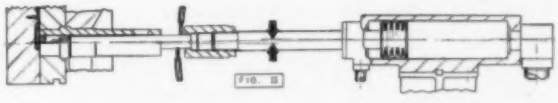


that run into the tip to keep the tip cool, which prevents seizing. Water is fed into and out of the plunger rod through hoses. This plunger rod is then loosely coupled to the hydraulic injection cylinder, which is mounted on its own support. This support is usually adjustable, since, as different die conditions warrant, the injection system is moved up or down.

Great Speed and Pressures Required

To make castings of high density it is important that the metal be injected at great speed and under great pressures that often reach over 35,000 p.s.i. **Fig. 2** shows the injection system under pressure with the metal injected into the die. The two arrows point to misalignment between the injection cylinder and the shot sleeve or magazine.

This misalignment could be caused by a number of things. For example: a weak cylinder support could sag under pressure, the piston rod could be bent, the cou-



pling could be eccentric, the shot sleeve center might not coincide with the injection cylinder center, and finally, if the shot sleeve were improperly mounted in the die or machine, this would cause misalignment in the injection system.

In addition to speed and pressure, the injection system is subjected to an additional element: heat. Aluminum enters the shot sleeve near 1200°F., brass at 1900°F. Heat causes the shot sleeve to expand—also the plunger tip, which must be cooled to prevent it from seizing (or binding) to the shot sleeve.

Misalignment Affects Quality

Injection systems, when not properly aligned, cause the plunger tip to scrape and score both the tip and the shot sleeve. This scoring causes a very slight hesitation in the injection of the metal, which greatly affects the quality and density of the casting. In addition, it causes premature destruction of the tip and shot sleeve. When excessive scoring takes place, the metal soon spits back through, between the tip and the sleeve. Then the tip and sleeve must be replaced.

The shot sleeve can be reworked to a larger inside diameter and a new tip fitted to this. The removal of this shot sleeve requires the removal of the die, at least the stationary half of the die, which in some cases might

cause the loss of the die casting machine production for an eight hour period.

Since the alignment is such a large factor in the function of the injection system, a close coupled type has been developed as shown in **Fig. 3.** In this system the injection cylinder is mounted directly and concentrically to a shot sleeve holder, which is carried by the stationary platen of the machine without any additional cylinder support.

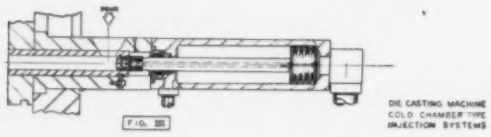


FIG. III

The plunger tip is cooled by the hydraulic fluid that is used in the injection cylinder. It passes through an orifice, or check valve, into the tip, back through the cylinder rod, out through two small holes through the heat exchanger to the hydraulic fluid reservoir.

Benefits of Hydraulic Fluid Cooling

The cooling of the tip by hydraulic fluid such as oil or non-inflammable fluids is less drastic or shocking than with water. In addition to this, the circulation of a small quantity of fluid through the injection cylinder keeps the temperature of the fluid in the cylinder at a moderate level. This keeps the cylinder seals and packings from becoming brittle from extreme heat. In water cooling systems, passages sometimes are clogged by lime deposits which would be avoided by hydraulic fluid cooling.

The advantages of this close coupled injection system are:

1. Positive alignment.
2. Close coupled (short and rigid).
3. Moving parts safely guarded.
4. Shot sleeve changed without removing die.
5. No external supports.
6. Simple maintenance and height adjustment.
7. No exposed cooling lines.
8. Adaptable to existing machines.
9. Interchangeability of complete units.
10. Provision for automatic tip lubricator.

A plan view of the close coupled shot system is shown in **Fig. 4.** This shows a tie-rod-type cylinder with

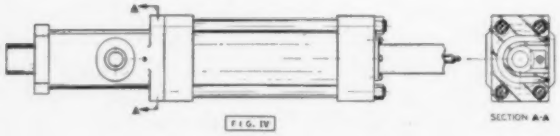


FIG. IV

a water cooling extension out the rear end. This is further illustrated in **Fig. 5.** In order to keep the cylinder packing at a moderate temperature, a horseshoe-shaped cooling channel is cut into the end of the shot sleeve container. In this type of shot system the water cooling extension is a non-stressed member as compared to the plunger extension in **Fig. 1.** As shown in **Fig. 5** the injection cylinder is just slightly smaller in diameter than the shot sleeve container. This is so that the entire injection unit can be removed from between the machine platens.

A Look at the Plunger Tip

Sleeve-type Shot Tip—In order to improve the injection system's alignment right to the end we must look at the plunger tip. The purpose of the tip is to drive the molten metal into the die cavity, and seal the metal out from between the sides of the plunger tip and the shot sleeve. To do this with a solid, one piece tip is difficult. When the hot metal comes into contact with the tip, the tip expands, which causes scoring of the

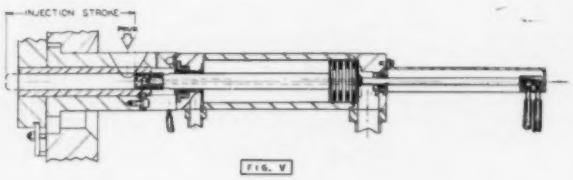
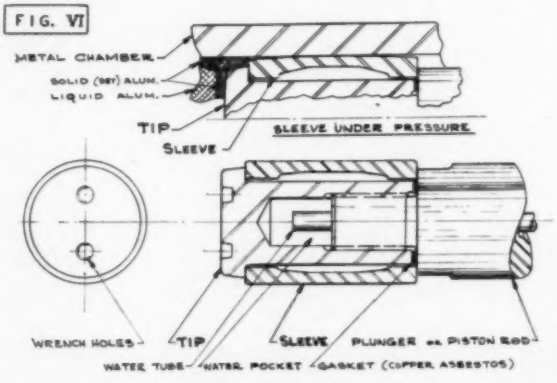


FIG. V

shot sleeve. Then, when the tip is retracted, it is cooled and contracted, which allows the metal to squirt through along the sides of the tip when the next shot is made. Then, too, when the tip becomes scored, it is necessary to replace the entire tip, since it is now undersize to the sleeve diameter.

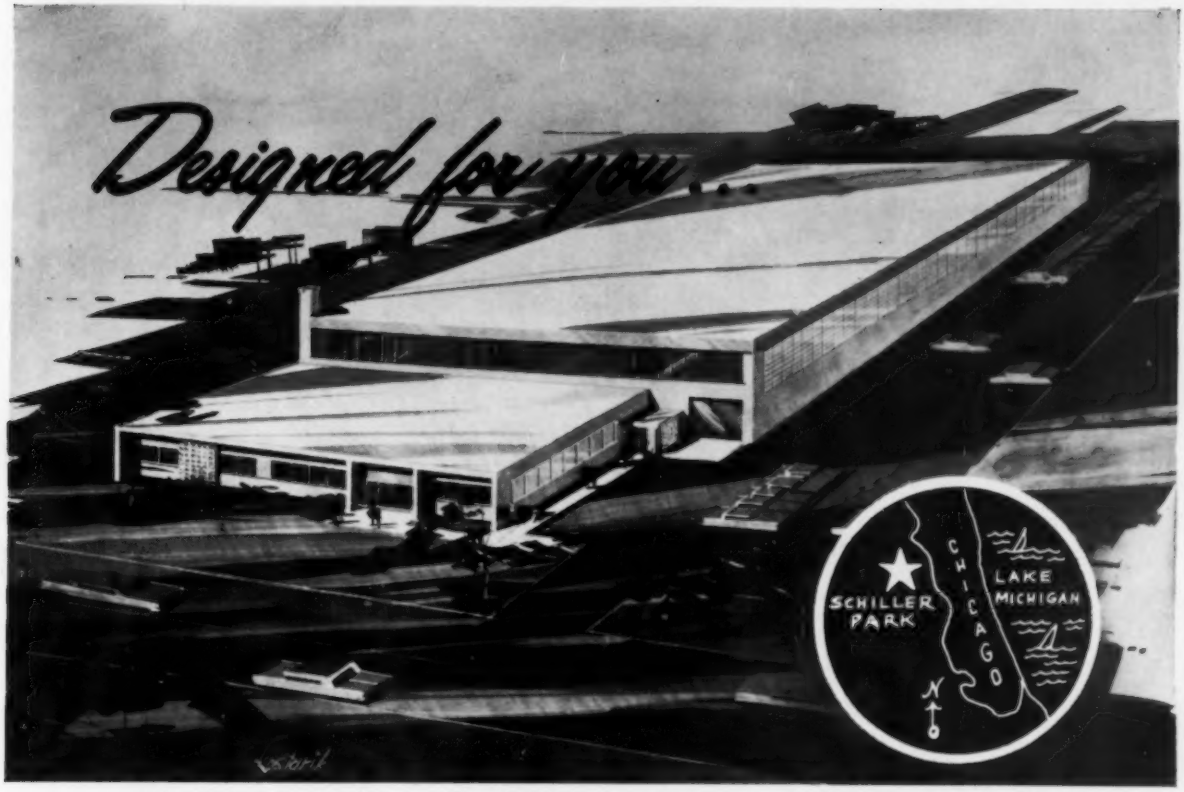
FIG. VI



INJECTION PLUNGER TIP
SLEEVE TYPE - SELF ALIGNING - PRESSURE SEAL

With the tip shown in **Fig. 6** it is necessary to change only the inexpensive tip sleeve should it become scored. Another feature of the sleeve is that it stays at a constant temperature while the cooled tip "sets" the hot metal. In this way the sleeve maintains a constant tip-to-sleeve seal. In addition, the sleeve has a self-aligning clearance which corrects rod-to-shot sleeve misalignment and eccentricity.

A solid tip cannot do the complete injection job that a sleeve type tip can accomplish. With a sleeve type tip, alignment on existing die casting machines might also be improved.



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The sessions of the Technical Congress will be held at the Armory, in conjunction with the Exposition. The subjects and authors for the sessions were carefully selected to bring you the most complete technical program in the history of the die casting industry.

The value of attendance is illustrated by the large number of advance registrations from die casting people from all parts of the world.

The scope of the Congress is illustrated by the following outline of the sessions, showing titles of papers and their authors.

PROVISIONAL PROGRAM

SESSION "A"—DIE DESIGN

Tuesday, November 8
9:30 A.M. to 12 Noon
Moderator: Stanford Landell
Brown-Lipe-Chapin
Division—GMC

MATHEMATICAL DETERMINATION OF DIE DESIGN
By: John Caster,
Consultants to Industry

FURTHER REMARKS ON GATE DESIGN IN ALUMINUM DIE CASTING
By: John Lapin
Central Foundry Div., GMC

SESSION "B"—DIE BUILDING

Tuesday, November 8
1:30 P.M. — 4:00 P.M.
Moderator: John M. Atols
Atols Tool and Mold Corp.

MOLD FABRICATION — COST REDUCTION and CONTROL
By: Rolf H. Berg
Atols Tool & Mold Corp.

H-13 STEEL AS USED IN THE DIE CASTING INDUSTRY
By: Arthur E. Scholz
Crucible Steel Co.
of America

TEMPERATURE RELATED TO MOLDS AND CASTING PROPERTIES
By: Ross Dean
Sterling, Inc.

SESSION "C"—METALLURGICAL DEVELOPMENTS

Wednesday, November 9
9:30 A.M.—12 Noon
Moderator: F. William Foss
Apex Smelting Company

STUDIES ON THE INFLUENCE OF GAS CONTENT, PRESSURE, AND MAGNESIUM CONTENT ON THE MECHANICAL PROPERTIES OF ALUMINUM DIE CASTINGS.
By: Dr. Werner Ruegg
INJECTA, Limited
Teufenthal, Switzerland

ALLOY CONTROL FOR ZINC DIE CASTINGS
By: J. L. Kimberley, and
Ernest W. Horvick
American Zinc Institute

METAL HANDLING AND CONTROL
By: F. Wm. Foss
Apex Smelting Company

METALLOGRAPHY OF DIE CASTINGS
By: G. Leslie Armstrong
U. S. Reduction Company

SESSION "D"—WHAT'S AHEAD IN DIE CASTING

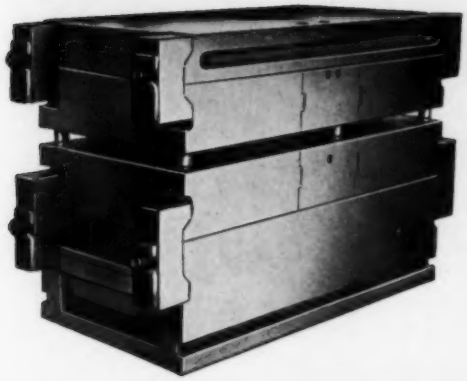
Wednesday, November 9
1:30 P.M.—4:00 P.M.
Moderator: John Wall
Permanent Mold Die Co., Inc.

ULTRASONIC VIBRATIONS IN DIE CASTING
By: Earle W. Rearwin
Reed-Prentice Division

PLATING AND ANODIZING OF ALUMINUM DIE CASTINGS
By: Robert Harder
Lukens Aluminum Company

HOW CASTINGS AFFECT QUALITY OF ELECTRO-PLATED ZINC DIE CASTINGS
By: Wm. H. Safranek
Batelle Memorial Institute

CONTINUED ON PAGE 25 ■



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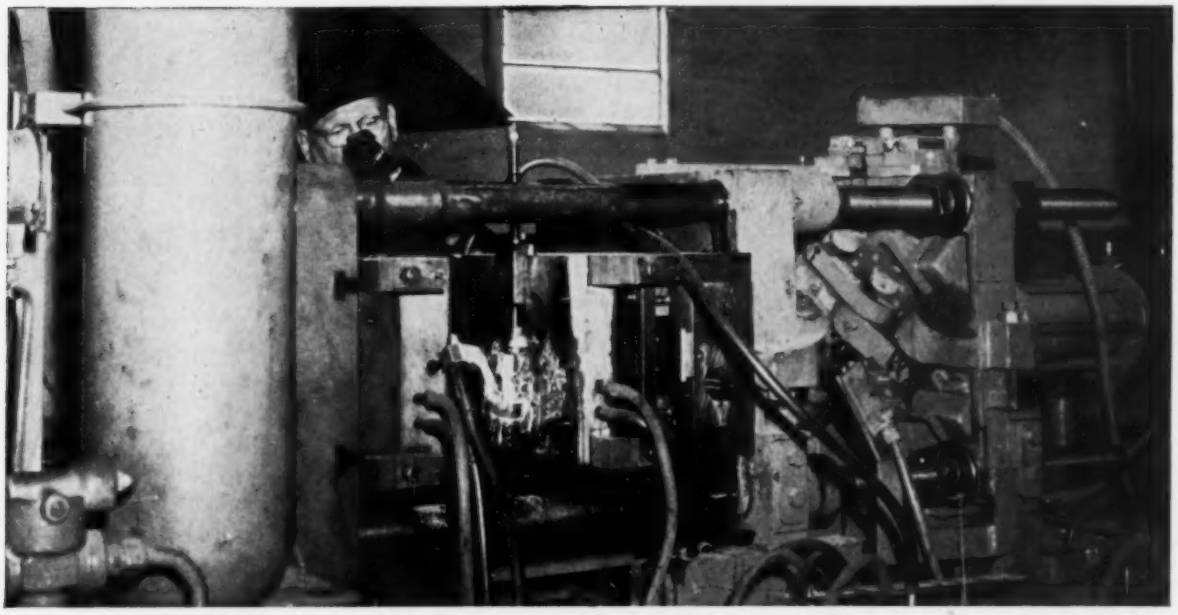

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CIRCLE 8 READERS SERVICE CARD

THE FINAL QUALITY OF ALUMINUM DIE CASTINGS ORIGINATES AT THE FURNACE

By J. A. KOZMA, Jr.
J. A. Kozma Company

WITH THE ACCELERATED REQUIREMENT for aluminum die castings of thinner section, larger in size, with greater strength and ductility, that may be welded, anodized, enameled, or heat treated, greater emphasis must be placed on metal quality.

The metal must be melted and held in a manner that will greatly minimize oxide inclusions, hydrogen absorption, and temperature variation, as the casting process actually originates at the dip well of the furnace and neither the casting machine nor the die has the ability to improve upon the metal while producing a casting.

The metal must be delivered to the dip well in a truly liquidus state free of "sludge." Since the quality of the

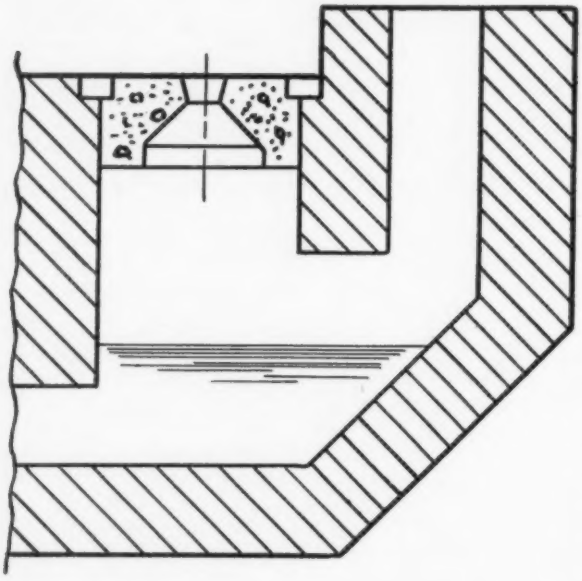


FIG. 1

casting is no better than the quality of the metal from which it is cast, the furnace must be considered as one of the most important factors in the die casting process. Continued research in the field of furnace design has provided several basic new concepts that materially improve upon the quality of aluminum die castings.

Ingot Pre-heat Charging Flue

Substantial pre-heating of aluminum ingots prior to immersion has been found to greatly reduce oxide inclusions

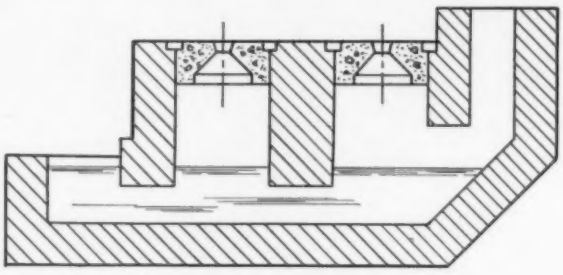


FIG. 2

and segregation in the bath as compared to melting on a dry hearth or charging cold ingots into the bath.

This is accomplished by means of a specially designed charging flue, as shown in Figure #1, which prevents total immersion of the ingots into the bath until sufficiently preheated by exhaust heat from combustion.

Several advantages are immediately apparent: As there is virtually no change in the shape of the ingot during preheat, the only oxides that enter the bath are those contained in the "oxide film" formed prior to charging the ingot into the furnace. The fact that the "oxide film" is not disturbed is also important in reducing porosity since it prevents the metal which it surrounds from absorbing hydrogen.

An additional benefit of the ingot pre-heat technique is a narrowing of the bath temperature fluctuation range. Because a large percentage of the heat required by the ingot is absorbed prior to immersion, less heat is drawn from the bath itself to bring it to the molten state. This results in a greatly reduced tendency to segregate alloying elements frequently caused by cold ingot immersion. Quality of the metal is retained, porosity reduced and casting machineability is improved.

Radiant Heat

Radiant panel firing minimum forward velocity offers decided advantages in maintaining highest possible bath metal quality. Because there is virtually no forward velocity at bath level, the surface of the bath is not disturbed and the

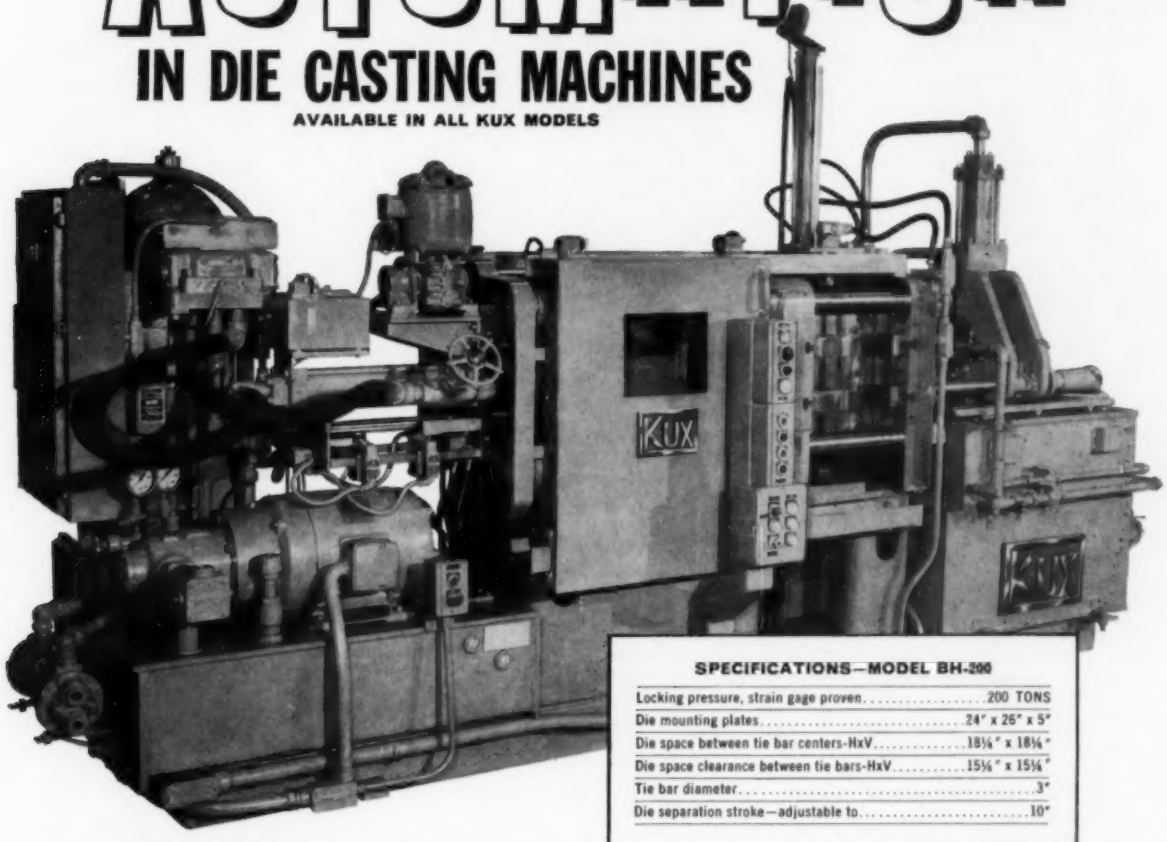
CONTINUED ON PAGE 20 ■

Another KUX unsurpassed design superiority

AUTOMATION

IN DIE CASTING MACHINES

AVAILABLE IN ALL KUX MODELS



SPECIFICATIONS—MODEL BH-200

Locking pressure, strain gage proven	200 TONS
Die mounting plates	24" x 26" x 5"
Die space between tie bar centers-HxV	18¼" x 18¼"
Die space clearance between tie bars-HxV	15¼" x 15¼"
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Die separation stroke—adjustable to	10"

Up to 900 free cycles per hour...
500 to 700 casting cycles per hour } AUTOMATICALLY — CONTINUOUSLY

You're looking at the new KUX Model BH200—the 200-ton strain gage proven hot chamber die casting machine, which will continuously produce vast quantities of hardware finish castings with minimum maintenance and down time. Automatic operating mechanism permits a cycle with a full 10" of die movement and 6" of metal injection stroke in 4 seconds. A 6¼ lb. zinc shot can be produced in this heavy duty machine at 1800 PSI injection pressure. Sensing safeties retract the die plate and prevent recycling of machine if there is flash on the die surfaces.

Incorporated into this machine cycling mechanism is a low pressure approach of the moveable die plate, flash sensing switches, air jets for cleaning die faces, casting sweep arm, and die lubricating unit with adjustable interval timing. Also available in cold chamber models for casting aluminum with KUX "AUTO-FEED" system of vacuum die casting.

ADDITIONAL FEATURES in the 28 all-new strain gage proven KUX models are the revolutionary "VAC-U-DIE" and "AUTO-FEED" systems of vacuum die casting—motorized die height adjustment mechanism—and the patented KUX injection pressure multiplier for cold chamber models with injection pressures up to 36,000 PSI and plunger speeds up to 12,000 inches per minute.

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Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.

CIRCLE 9 READERS SERVICE CARD

The Art Column

Die Casting, that is!

THE "ART" OF ATTEMPTING TO "BEAT" TIME is old. Classic examples are the quest of the Fountain of Youth, goat glands, face lifting, perpetual motion and others.

The element of time is just as uncompromising in Vacuum Die Casting as it is in life itself, "Art" not withstanding.

We cannot as yet defeat time. There are many die casters who are spending huge sums of money and a great deal of effort trying to beat time with the use of various types of die evacuation systems—mostly with meager results.

The *results obtained from the application of vacuum to the die casting process are in direct relation to the time of such application.* This basic fact has been completely disregarded by the majority of the die casters who have applied vacuum to their die casting process.

Vacuum Needed in Full Cycle

The vacuum, to be useful must be present in the cavity during the entire filling cycle. We have instrumented all the various types of die casting vacuum applications. Many types applied to a variety of dies actually show greater back pressure in the cavity than the same cavity shows under the usual method of die casting using vents alone.

It is hard for the operator or the engineer to realize this when he looks up at the bourdon type gauge and it shows 28 inches of vacuum just before he pushes the shot button. He assumes that he has 28 inches of vacuum all the time the shot is being made and the cavity is filling. Instruments have proven that such it not the case. Actually he may end up having an equal pressure in his cavity for 75 per cent or 80 per cent of the cavity fill. This causes voids and porosity. Most times these voids and this porosity is greater than it is under usual injection methods using a vented die.

A Simile Is Cited

A simile that is easily understood would be that of filling a vessel from the bottom, this vessel having an opening in the top. If you leave the top opening clear to the atmosphere, the vessel fills easily. If you apply vacuum to the top opening it fills faster and easier. However, if, when it starts to fill, you close off the opening on top, the filling stops and a pressure develops in the unfilled portion of the vessel equal to the filling pressure. An unfilled pressured void is the result.

We have instrumented these vacuum applications to dies by the use of strain gauges on ejector pins, and by the use of capillary ejector pins, water cooled. These are in turn, of course, coupled to transducers. When instrumenting dies where a shutoff valve in the die is part of the system, we place a sensing transducer on the valve. This makes it possible to secure a pattern showing the entry of the metal, the closeoff of the vacuum valve, and the buildup of pressure after the valve closes.

Transducer Range Exceeded

Our transducer on the cavity pressure capillary pin was calibrated to 3000 PSI plus, and 32" minus. In several cases we have exceeded the range of the transducer; that is, we have gone over the 3000 PSI back pressure, and this while we supposed we had a vacuum in the cavity.

We found that when these valves were operated with air and controlled with solenoids using AC current, that the difference from shot to shot varied greatly. In some cases, the back pressure exceeded 3000 PSI, and in other shots even held to close to 0. We noted that the back pressure was in direct relationship to the closeoff time of the valve in relation to metal entry. This is timed in milliseconds.

When the dies were equipped with the hydraulic balance circuit, we found that the results were much more uniform. However, plunger and metal temperature did affect the hydraulic balanced pressure and the timing of the closure. However, we had no difference due to the AC variation or the air pressure fluctuation.

Closing of Valves Sensitive

We found that the closing of these valves is very sensitive. If closed too fast, especially with air, they would hit and bound open. The hydraulic action was better, and was much better when using Bellville washers for counter balance.

We instrumented the old thermal block method and found that we only get a back pressure when the venting to the block is improper; that is, when the metal hits the vents and blocks off before the cavity is filled.

By holding shots from filling, that is, by preset blocks, we found that the loss of vacuum through ejector pins and die edge was faster than cavity filling. We would lose 80 per cent of our indicated vacuum in about 200 milliseconds, this on a die with eleven ejector pins fitted to close working tolerance. We could not determine what part was actually lost from the seal edge, and what part through the pins.

Ejector Box Enclosed

We were not wholly successful in sealing off the pins without enclosing the entire ejector box. Mating edges of the die were not sealed off except for certain test conditions when we used a caulking seal on the die surface.

We found that the practice of leading all cavities into a common collecting runner was the cause of much back fill in some cavities. This was determined by placing trace material on the outlet of a cavity. We found the material within the cavity in some cases, and in the common runner in others. It was concluded that all cavities need to have their own individual vents.

On aluminum dies we found that a great deal of air at high velocity entered the cold chamber around the plunger. This gave us a high froth on the metal in the cold chamber. The result was high oxide and porosity in the casting, and this made the machining of the casting difficult.

Aluminum Dies Enclosed

On the aluminum dies we built a complete enclosure around the die, making sure that the die was under a complete vacuum at the time the shot was made and that the vacuum continued past the solidification period. Normal gating and venting was used.

The instruments still indicated a large range of variable vacuum conditions at the time of the shot. We had no back pressure, however. The vacuum drop was variable. This vacuum drop was traced to the leakage taking place around the plunger. The variable was due to a difference in the seal effect of the plunger lubricant.

Cold Chamber Sealed

The cold chamber was then completely sealed from any outside air leak. The instruments then indicated a very small drop and the drop was the same for each shot and for each condition of temperature and of plunger lubrication.

Using the complete instrumentation, production runs of one thousand to fifteen hundred shots per series were run. The variation was less than 2½% on each scale. Visual and x-ray examination of the castings indicated castings of high quality, low porosity and good surface conditions. Quality was uniform for each condition.

CONTINUED ON PAGE 26 ■

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Now, *from stock*, you can obtain longer-lasting *steel* goosenecks* in nominal sleeve sizes for your die casting machines. Dodge goosenecks are machined and sleeved, ready for your use.

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THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

CIRCLE 10 READERS SERVICE CARD

Some Observations . . .

ON THE USE OF SOUND WAVES IN DIE CASTING

By ED. A. DAY

American Charcoal Company

(From an address by Mr. Day to the Chicago Chapter of the S.D.C.E.)

IT HAS BEEN SUGGESTED that the scientific application of sound waves, both sonic and ultrasonic, might help solve many of the vexing problems which confront the die caster daily.

According to some prominent researchists, the use of "sound" waves could conceivably produce a revolution in the die casting industry. Their proper application has already demonstrated a certain utility in improving die life, reducing machine cycle time, permitting lower temperatures and hydraulic plunger pressures, minimizing porosity and shrinkage, substantially increasing "skin" thickness and producing a level of crystalline uniformity approaching that found in the best forgings.

Some shops experimenting with sound wave techniques in the last three years report results which, in certain circumstances, verge on the spectacular. Although these companies are not yet ready to publicize their findings, the preliminary indication is that sound waves will play an important role in the forward-thinking die casting operation of the future. As with vacuum, sound waves will not be a crutch for the inefficient operator to lean upon. However, properly used, the new sonic technology promises to serve as a useful tool in obtaining castings of superior quality.

Uniform Solidification Induced

Basically, the utilization of sound wave energy in die casting has been accomplished by the application of (a) ULTRASONICS, or inaudible sound waves in excess of 20,000 cycles per second, and (b) SONICS, or sound waves in the audible range below 20,000 cycles per second. Transmitted to the molten metal through the die by means of a suitably designed vibrator, in the case of sonics, and transducers, in the case of ultrasonics, this energy tends to induce uniform solidification and prevent premature freezing in critical areas of the casting.

In a conventional die, vents are often blocked by the first inrush of molten metal, which causes gas entrapment. Then, as additional molten metal enters the cavity, surrounding pockets of gas, shrinkage and porosity develop in the casting As every die caster knows, these are the chief causes of production scrap and breakdown of die cast components in service.

However, by vibrating the molten metal as it enters through the gate, solidification is delayed momentarily, but long enough to permit gases trapped in the metal and present in the cavity to be released through the vent openings. Good venting practices must always be observed in order to obtain a sound casting. The proper use of sound waves together with correct venting, provides a casting of even higher quality, better able to accept a plated finish, resist corrosion and fill higher physical property requirements.

"Pulling" No-Draft Cores

Another use of sound waves is in "pulling" no-draft cores. This technique involves the application of longitudinal vibrations to the end of the core, thereby imparting a microscopic push-pull motion to the core. The movement so obtained prevents the shrinking metal from locking on the core, and allows it to be readily withdrawn. The energy for this effect must be provided by an ultrasonic, rather than a sonic, source due to the relative ineffectiveness of lower frequency vibrations when in longitudinal form.

It has been found that, under certain circumstances, a significant reduction in machine cycle time is obtained when sound wave techniques are correctly applied. One hypothesis advanced in explanation of this phenomenon is that the substantial removal of gas in contact with the cavity wall due to turbulence in the fluid metal permits quicker and more even transfer of heat from the metal to the die block. No doubt the tendency towards thermal homogeneity as a result of the metal being "in motion" immediately after injection also makes a contribution to faster freezing of the casting.

Die Erosion Abated

A traditional method for obtaining superior finishes on a die cast part has been restriction of the gate area to build up injection velocity and freeze a thin layer of metal uniformly against the cavity wall while it is still at elevated temperature. However, high velocities promote die erosion and eventually lead to costly repair or replacement. By vibrating the die block the gate can be opened up and the true velocity lowered, with a consequent abatement in the erosive attack of hot metal impinging on die surfaces. At the same time, the peculiar action between metal and die lends an apparent velocity to the metal which has the actual effect of providing the finish desired. The physical occurrence within the metal responsible for this effect, called "cavitation," is only obtained under the correct conditions of frequency and amplitude. The die caster may take the advantage attributable to cavitation not only in the form of a larger gate and lower impingement velocity but, if he wishes, in terms of lower molten metal temperature or reduced injection pressure, or some combination of all three variables.

The following is an explanation of some of the common terms used in this new science:

ULTRASONIC ENERGY—There are many ways of producing intense, high-frequency vibrations in a liquid. All have two basic elements in common: a generator or energy source, and a transducer to introduce the energy into the liquid. The generator is usually separated from the transducer, and connected to it by a cable. Sound waves of considerable energy can be generated over a very wide range of frequencies. The generally accepted range commercially useful for casting extends from about 20,000 cycles per second, the upper limit of human hearing, to 100,000 cycles per second. The desirable results obtained with ultrasonic vibration of the die block are due to cavitation in the molten metal. A minimum level of acoustic energy must be introduced into the metal to produce cavitation in the ultrasonic range.

CAVITATION—Ultrasonic cavitation is a complex phenomenon which is not yet completely understood. However, for most practical purposes, it may be considered a rapid generation and violent collapse of minute bubbles or waves in the molten metal. This produces countless small, but intense impacts, much like the action of thousands of rapidly moving scrubbing brushes, at the surface of solid materials in contact with the liquid. Without cavitation, regardless of the power or frequency used, little or no densifying of the casting will occur.

GENERATOR—The generator, as its name implies, is the source of power for the system, and usually employs an electronic oscillator. Although conventional alternators or electro-mechanical devices are capable of producing such power, they lack the principal advantages of electronic systems, in which simplicity, elimination of moving parts, reliability, and ability to produce highly efficient pulsed power are obtained. Generators are normally rated in average wattage output and in peak wattage (two to four times average).

TRANSDUCER—The transducer is the device which transmits electrical power from the generator to the object to be vibrated (in this case, the die block or the core). In ultrasonic casting, there are two basic materials which perform efficiently the transducer's function of converting electrical power into mechanical motion. One utilizes the property of certain ceramics and crystals to change shape when an electric potential is applied to them (piezoelectric). The other depends upon the ability of certain metals, such as nickel, to change dimensions when magnetized (magnetostrictive). To produce efficient transfer of acoustic energy to the die, large transducer radiating areas are necessary. Small areas require high amplitudes, which tend to produce excessive cavitation and erosion at the transducer face, and to reduce energy transfer to the liquid metal.

PIEZOELECTRIC TRANSDUCER—Ceramic, or piezoelectric, transducers provide one of the most satisfactory and economical means of activating a liquid. Synthetically produced of barium titanate, the material is easily formed into the most efficient shapes to provide relatively large radiating areas. At resonant frequency, the transducer has high electro-mechanical conversion efficiency. Some ceramic transducers are mounted in a hermetically sealed stainless steel housing, one surface of which is the radiating face. The barium titanate elements are attached to the side of the housing by a specially developed bonding method. Transducers of this type have been in constant service for more than three years and have proved completely satisfactory. Quartz crystals have many of the same characteristics as ceramics elements; however, their use in ultrasonic casting has been limited by the need for high operating voltages, the difficulty of obtaining large crystals, and poor behavior at high temperatures.

MAGNETOSTRICTIVE TRANSDUCER — Magnetostrictive transducers, when properly designed, withstand temperatures well, and provide high vibration amplitudes, particularly at lower frequencies. However, the units that have been built so far are heat sensitive and cannot be used in contact with a hot die without a costly cooling set-up. It is expected that this limitation in magnetostrictive transducers will be overcome in time through design refinement.

TRANSDUCER ARRANGEMENTS—General considerations in any transducer arrangement are: Power input should not be greater than necessary to accommodate the work load; the work should be brought as close as possible to the radiating surface of the transducer; reflection, focusing and interference effects should be considered. Focusing of vibrations to a specific die section or component for the purpose of obtaining desired local effect can be accomplished by employing a special wave sweep mechanism.

GENERAL CHARACTERISTICS—Since it is cavitation that is mainly responsible for the advantages obtained when ultra-high frequency sound waves are applied in die casting, any characteristic in molten metal which encourages cavitation is desirable. Dense liquids transmit energy more readily, as a rule, than those having low specific gravities. The presence of excessive air or vapor reduces efficiency, but completely degassed liquids seem to require higher power per unit volume. The temperature of the liquid is a factor, for density is an inverse function of temperature.

SOUND WAVES—Sound waves fall into two separate and distinct categories, the transverse and the longitudinal. Both occur, or are produceable, in both the audible and inaudible ranges. Longitudinal waves cause particles in the medium to vibrate in the same direction in which the wave is moving, while transverse waves cause the particles in the medium to vibrate at right angles to the direction in which the wave is moving. The wave length is the distance between a given point on one wave crest to the corresponding point on the adjacent wave crest. The number of times a wave crest passes a given point in one second is the frequency in cycles per second. The frequency to be applied to the transducer for optimum results is determined by the density of the molten metal at its temperature just after injection into the die.

—— DCE ——

According to those who have done a great deal of work with the process, sonics and ultrasonics have a most interesting and promising potential in assisting the die caster to overcome some of the serious problems he faces in obtaining consistently high casting quality. Credit for research and development in sonics and ultrasonics in the foundry industry should be given to Dr. Mel Allen of M.I.T., who applied sonics to permanent molding, to Dr. J. J. Schrumm of Reno, Nevada, for his use of transverse waves in a similar application, and to Mr. John A. Weber, General Manager, Southern Die Casting & Engineering Co., High Point, North Carolina, for the use of mechanically-induced high frequency vibrations in his Vibrocast process.

NOV. 8-11

BRING A FRIEND To The EXPOSITION

NEW FEATURES IN UNIT DIES DEVELOPED TO MEET NEW DEMANDS

Editor's Note: Supplementing the article in our July issue on Unit Dies, the following features of design have been developed to meet new demands, as presented by Herman M. Canner of Sterling-Detroit Company.

—— DCE ——

THE WIDESPREAD USE OF UNIT DIES by die casters, particularly those classified as "job shops," indicates recognition of the advantages in this manner of tooling. Admittedly, there are also limitations in their use, just as there are in every tooling process. A well-designed tool is one which has been engineered to eliminate or decrease the minus factors, and increase the plus factors.

The principal disadvantages inherent in most multiple Unit Master Dies are:

1. Unbalanced ejection loads.
2. Limited access for core-pulls.
3. Inability to run parts which require sleeve ejection.
4. Die casters require the services of a tool maker in addition to a set-up man.
5. No provision for running die castings on a fully automatic basis. (No operator.)

Unit Die holders now are being produced incorporating all of the familiar virtues of Unit Die construction, completely eliminating the above-listed disadvantages. These masters are made to operate in all types of standard zinc or aluminum die casting machines.

An "equalizer mechanism" built into the master balances out the difference in required ejection forces of the various units, and can be operated by bumper-bars, hydraulic ejection, mechanical link, or rack and pinion.

Without the "equalizer mechanism," the "racking" of the ejector plates would make it either impossible or impractical to run certain combinations.

In addition to keeping the ejector plates in one plane regardless of load differential, the "equalizer mechanism" provides a means of ejecting with an auxiliary hydraulic cylinder which, when used, does not transmit any of the ejection force to the machine or the platen clamping bolts. This is particularly important when the required ejection forces are very high and the die casting machine is a "link" type.

A by-product advantage which comes from this type of ejection is the ability to use ejector pins under core pulls when such location would be advantageous and the die casting machine being used does not have hydraulic ejection built in.

The design of such masters permits the mounting of core pull mechanisms on three sides of any unit. Sleeve ejector core plates and support pillars, when required, are made a part of the replaceable Unit Die. Thus, the changing of units can be done quickly by a set-up man without the assistance of any additional skilled help.

In order to facilitate quicker removal of shots from the dies, and also to permit the running of Unit Dies on a fully automatic cycle without a machine operator, the masters are made with the provision for "quick ejection." The technique used is the relative acceleration of some of the ejector pins during the latter part of the ejector travel.

The increased versatility of this advanced type of Unit Die design has broadened Unit Die application and has put its users in a more favorable competitive position.

FINAL QUALITY

■ CONTINUED FROM PAGE 14

protective oxide film remains intact. Clean metal is thus prevented from rising to the surface to form further oxides. Additional hydrogen pick-up from air in the furnace atmosphere, as well as from the products of combustion, is practically eliminated. At the same time, radiant panel firing provides faster, more uniform heat distribution and virtually eliminates flame impingement.

Sub-Surface Metal Flow

Sub-surface flow of metal from the melting zone to the holding zone to the dip well, as shown in Figure #2, has also been found to reduce dross pick-up and oxide inclusions. This ideal metal flow system is obtained through the use of zone dividing walls that extend below the surface of the bath. The surface oxide film is maintained undisturbed as a barrier against impurities from the several sources that greatly affect final metal quality. Metal is kept sub-surface clean until it is taken from the dip well.

These three elements of basic furnace design—pre-heat charging flue, radiant heat and sub-surface metal flow technique—are combined with proper selection of refractory materials to assure highest metal quality and low porosity of the final casting, as demonstrated by the cup sample shown in Figure #3 which was cooled under 26 inches of vacuum.

Several resulting in-plant economies directly related to furnace design provide additional benefits to die casters; overall metal loss is reduced; smaller bath requirements

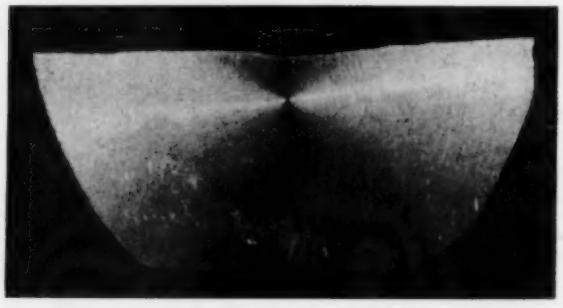


FIG. 3

provide a higher yield per square foot of floor space; frequency of fluxing and degassing is reduced and less materials are needed; extremely low fuel consumption (approximately 1,000 BTU per lb.) cuts operating costs.

REED-PRENTICE

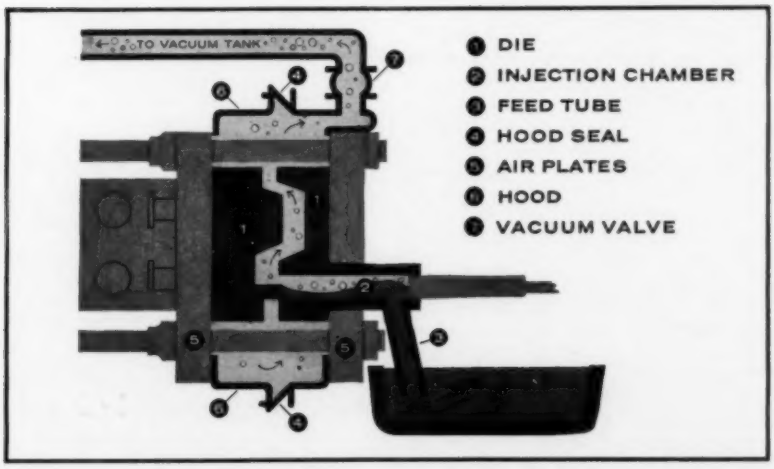
DIE CASTING NEWSLETTER

a look at vacuum die casting, its use and importance.

Vacuum die casting of aluminum offers as much promise for product design as vacuum die casting of zinc has in the past few years. Major improvements such as cleaner, lighter castings from a new spectrum of aluminum alloys make possible the use of new finishing operations as applied to die casting. In general, greater liberties can be taken with part design. Compositions that can be anodized, heat treated or brazed can now be successfully die cast. Improved tensile strength and uniformity make thinner walls and less support-metal practical.

REED-PRENTICE has developed an

automatic vacuum feed system that successfully combines vacuum die casting of aluminum with automatic ladling. This VACUFEED system, as the diagram shows, first transfers the aluminum from the furnace to the injection chamber in a fully enclosed passage maintained at pouring temperature. This protects the metal from oxidation and temperature fluctuation. Second, the molten metal is drawn from below the surface of the melt. There is no inclusion of the surface dross to impair the properties of the die casting. And third, each shot of molten aluminum is accurately metered.



The field for vacuum die cast aluminum parts is broad and growing—from thin, colorful, automotive trim strips and grill decorations to small watch cases, appliance parts and electronic components. REED-PRENTICE VACUFEED enables engineers to specify vacuum cast aluminum parts—with all the inherent die casting advantages—for designs and compositions never before considered. REED-PRENTICE engineering has pioneered to find the best way to die cast aluminum with a vacuum. The advantages are many, the savings greater and, most important, the complete equipment is manufactured by REED-PRENTICE. Complete details on the techniques of VACUFEED die casting is as close to you as your nearest REED-PRENTICE Sales Engineer. Call him today.

REED-PRENTICE

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CIRCLE 11 READERS SERVICE CARD

New Book Devoted To Die Casting Art

Publication of a very comprehensive volume on the art of die casting, especially suitable as a reference manual and shop training aid for the die casting industry, is announced by the American Charcoal Company, Detroit.

Entitled "A Visit with '500' Die Cast Plants," the 600 page, profusely illustrated volume was compiled by Ed. A. Day, general manager of the concern.

The Society of Die Casting Engineers feels that Mr. Day merits sincere compliments for completing the task of collecting the many articles contained in this volume.

A collection of informative articles and data on new developments and various operating procedures, Mr. Day's book is the first volume devoted only to die casting in some 15 years.

Within this volume, for example, he has compiled articles on all popular vacuum systems, prepared by the developer of each system.

In consequence, the reader can make his own evaluation of the various systems available. The same is true of many other topics embraced in its broad ranging contents.

— DCE —

Editor's Note

Note: The Society has received the following letter from one of its founding members. In view of the fact that it covers a subject of interest to all of our members and readers alike, it is published here in its entirety.

We are also planning to print our history—as requested in the letter—in our November DIE CASTING ENGINEER, after bringing it up to date.

O. Clayton

August 20, 1960

O. J. Clayton, President
S.D.C.E., Inc.
19382 James Couzens Hwy.
Detroit 35, Michigan

Dear Mr. Clayton:

I have been reading some of the articles in Mr. Ed Day's book "A VISIT WITH 500 DIE CAST PLANTS," and must say that he is to be highly complimented on the worthy job he has done in documenting so many of the vital areas of interest in die casting. Our industry has always been weak in its literature, and his effort fills a big void.

However, I note that he has prepared some information about the spokesman organizations for the industry, the Society of Die Casting Engineers and the American Die Casting Institute, which is not quite accurate and should be corrected. I refer to the copy on page nine of the book.

As you well know, the first organizational meetings for the purpose of establishing a technical society where die casters and those closely connected with the industry could meet and discuss topics of common interest, were held in October, 1954 (not in 1956). The Society of Die Casting Engineers, Inc. was subsequently chartered as a corporation by the State of Michigan in July, 1955.

As one of the original group of about ten individuals who conceived the idea of a Society of Die Casting Engineers, I can assure you that there was *absolutely no domination* or leadership by any particular group or industry. True, three of the "founding fathers" were employed at the time by the automobile industry, but they were in positions of fairly minor responsibility and were in no way acting on behalf of auto industry management. They, like the rest of us, five of whom were selling products to die casters, and the remaining two being employed by independent die casting shops, were motivated by a strong desire to help themselves technically. There was no professional body holding meetings which die casting engineers could attend and discuss their problems. We were simply reacting to the wish constantly expressed by friends and customers in the die casting business that a medium of exchange of ideas somehow be established. Then, as now, there was *no thought whatsoever* of catering to the special needs and desires of any particular segment within the industry. There has been no change in the original concept or policy of jobbing or in the captive area.

MEMBERSHIP is by *individuals*, and all those who are die casters, employed by die casting companies, or in any other way connected with the industry, are welcome to join.

In marked contrast, as I understand it, the American Die Casting Institute is a *trade* organization whose objectives are to protect the special interests of an exclusive group of jobbing die casters. Membership and participation is by company, not by individual membership. The A.D.C.I. engages in a certain amount of basic research and in the presentation of technical data to its members, but these activities are of secondary importance to the protection function. It is not the objective of trade associations such as the A.D.C.I. to promote the growth and health of the *entire industry*.

I would suggest that the society reprint the article titled "History of the SDCE" from the March 1957 issue of Die Casting Engineer, so that further misunderstanding does not occur.

I hope these remarks will help clear up some of the doubts and misconceptions which may exist in the minds of those connected with this great industry.

Sincerely yours,
American Prototype Industries, Inc.
(Signed) George F. Griffenham
President.

OBITUARY

J. Merle Hosdowich, chromium plating pioneer, died at Tucson, Arizona, July 15. He retired last year after 35 years' service with Metal Thermit Corporation. He was 65. A graduate of Carnegie Institute of Technology—B.S. in Mechanical Engineering — Mr. Hosdowich held a research fellowship at Mellon Institute in Pittsburgh.

Word has just recently been received at the SDCE offices of the death last November 30 of member Edward C. Mielke, of Latrobe Steel Company, Chicago.

Theo T. Witt, purchasing agent for the Woodstock Division of Electric Auto-Lite Company, Woodstock, Ill., passed away Aug. 28, 1960. Mr. Witt was well known throughout the industry.

We extend our sympathy to George A. Cenkner, service engineer, Atlantic Chemicals & Metals, on the passing of his brother Michael J. at 42, on August 27.

SDCE Desires Old Aluminum Dies for Development Work

This is an appeal to members and friends. We need some old aluminum dies. Can you help? We need these dies in order to continue development work in instrumentation and other aspects of die casting.

The dies must be obsolete. We must be free to change and cut them up. They will not be returned. They should be suitable for a 400 ton machine. Please advise the Society of Die Casting Engineers' office if you can help us, giving a brief description of the dies.

Zinc Replaces Aluminum In Mounting Bracket; 75% Savings Realized

Conversion to a zinc die casting has effected a production cost saving of 75 percent for a commutator mounting bracket for a stenciling machine, once made from aluminum. Made for the Defiance Machine and Tool Co., St. Louis, Mo. by A. B. Mueller Co. also of St. Louis, the zinc die cast part now costs $1.00 as against $4.00 for the original aluminum sand casting.

The switchover was made to zinc for several important reasons:

1) Machining was reduced considerably.
2) The die cast zinc has greater tensile strength than the sand cast aluminum.
3) As redesigned for zinc die casting the part is less bulky, and metal was conserved because of thinner walls.
4) The part as die cast has a smoother surface.

The Aluminum Sand Casting

The aluminum sand casting required many secondary operations after the usual post casting clean-up—that is, breaking away the risers and fins. These included milling the working surfaces and two slots; milling the radius in two directions; machining fine mounting surfaces; drilling and tapping six holes. Machining the radius was very expensive since it had to be milled to close tolerances. In all, a total of 21 machining operations were required.

The Zinc Die Casting

The zinc die casting requires only casting and trimming. Holes and slots are cored and the radius is made directly from the die construction. "As-cast" tolerances are held ± .002 on the mounting surfaces, and to within ±0.005 for the hole spacing. On original conversion, the first run of 1000 pieces justified the die cost.

Because of the benefits here realized from use of zinc die casting, Defiance Machine plans to convert eight more parts from aluminum to zinc.

WE'LL SEE YOU

NOV. 8-11

TAKE ANOTHER LOOK AT THE

TECHNICAL PROGRAM

Don't orbit stuck castings...use Die Slick!

If your die casting shop engages in long-run production you may be able to standardize on—and save big money on—a pre-mixed, ready-to-use Die Slick compound especially formulated for the particular job. As a 20th Anniversary special we invite you to send us a letter describing your job in detail. We'll send along a trial quantity, tailor-made to your requirements and let you experiment. You be the judge of performance. If the custom sample outperforms a Standard Die Slick Compound—we'll give you a firm per-drum quotation on your "private stock." We guarantee to control quality on subsequent re-orders, and you avoid storing and mixing thinners and other variables. Please shoot us your letter. We can't start until we hear from you, and you're not under any obligation.

Die Slick is a registered trade mark of G. W. Smith & Sons, Inc.

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used by die casters everywhere

G. W. SMITH & SONS, INC.,

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CIRCLE 12 READERS SERVICE CARD

NEWS of the INDUSTRY

CORRESPONDENTS DESIRED

We are pleased with the many comments on the improvement of the "Die Casting Engineer." It is our aim to further improve the scope of coverage of our editorial text, selecting articles which create constructive thinking and the resulting technical advances and will be helpful for future reference.

The "Art Column" was established to deal with certain phases of the die casting process, and answer any particular problem or question you may have. Our readers are encouraged to express their comments on any article published or indicate subjects they desire to have published.

Those readers who have a flair for writing technical articles will find our editor and technical staff more than willing to aid in the preparation and rewriting of an article for publication.

— DCE —

Educational Program

The Society of Die Casting Engineers was formed in 1954 for the dissemination and exchange of information among engineers, die casters, suppliers, and others related to the industry.

That the Society has caught the imagination of many and fills certain needs for others is evidenced by its remarkable growth. The articles from the official publication, "Die Casting Engineer," the speakers at Chapter Meetings, and the technical conferences are some of the ways which are used to expand knowledge of die casting processes and technology.

Secretary of Labor James P. Mitchell recently released the results of a new major study by the U. S. Department of Labor. It is titled *"Manpower: Challenge of the 1960's."* It emphasizes tremendous expansion of the Nation's economy. At present, the population is increasing by about three million a year—the equivalent of adding to the country each year, three cities the size of Cleveland, Baltimore and St. Louis. These additional members of our society will require more food, clothing, shelter, education, medical attention, etc., and we must be prepared to produce more goods and supply these additional necessary services. The demand will be for a labor force not only 20 per cent larger, but, also a labor force that is *better educated* and better *trained* than at *any time in our history.*

In order to meet the challenge of the 60's, the Die Cast Industry must improve and expand its most important single investment, its manpower resources. To do this we must promote and develop Training Programs designed to provide an adequate supply of properly trained, technically skilled personnel.

— DCE —

Scholarship Fund Available

Since the inception of the Society, the Scholarship Fund has been established. The intent and purpose of this fund is to supply necessary monies toward the training and education of individuals taking technically approved programs related to the industry.

In order to meet the challenges of the 60's, the Society has adopted the following policy on education and training:

Die Cast Die Apprenticeship Programs meeting the requirements set forth by the Society, and registered with the appropriate State Agencies and the Bureau of Apprenticeship and Training, U.S. Department of Labor, will be the Society's initial project.

Long range plans call for forming Co-op Engineering Training Programs coordinated by the Society and the use of Scholarship Funds when requirements are met.

Die casting shops are invited to participate in this program by accepting a number of students per year for a "Learn and Earn Program."

We urge those interested in participating in our program to contact our national offices in Detroit.

— DCE —

Stresa Papers Available

Members of SDCE are urged to evidence their interest in purchasing a binder holding all papers presented at the Stresa Conference last spring. The papers cover varied topics of interest, such as gating costs, etc. The price will range between $12.50 and $15.00, depending upon the volume of orders the membership places with the Society. Why not place your order now?

— DCE —

Letter To The Editor

16 September, 1960

I would like to congratulate you on "The Art Column" of your May issue. This article has received considerable attention in this country and has certainly been read with great amusement within my own organization.

This Company commenced Pressure Die Casting in 1920 and now has 21 machines running on Zinc and 54 machines running on Aluminum, so you can well imagine that the "art" referred to in the article is very much with us.

I am attending the First National Exposition & Congress with my Chief Die Designer in November, and hope this will afford an opportunity of meeting you.

Yours sincerely,
R.D.T.
Worcester, England

— DCE —

New SDCE Pins Available

New and attractively designed SDCE pins and tie clasps will be available to members about October 1. They will be distributed through your chapter.

ALL STATE INDUSTRIES, INC.

Designers and Builders of

DIE CAST DIES — PLASTIC MOLDS — DIE FINISHING — DIE ENGRAVING

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CIRCLE 13 READERS SERVICE CARD

S.D.C.E. CONGRESS PROGRAM

■ CONTINUED FROM PAGE 12

SESSION "E"—COMPETITION TO DIE CASTING

Thursday, November 10
9:30 A.M.—12 Noon
Moderator: George Hovey
L. F. Grammes & Sons, Inc.

MODERN PERMANENT MOLDING AS A PROCESS FOR THE FOUNDRY
By: Frank Ross
Permanent Mold Die Co., Inc.

IMPACT EXTRUSIONS TODAY
By: James M. Rich
Aluminum Corp. of America

SAND CASTING PROCESS, A COMPETITOR OF DIE CASTING
By: Thomas B. Pfaff
Pontiac Motor Div., GMC

DICTAPHONE EXPERIENCE IN DESIGNING AND ENGINEERING COMPONENTS
By: Frederick W. Roberts
Dictaphone Corporation

PLASTICS — COMPETITOR OF DIE CASTINGS
By: Wm. O. Bracken
Hercules Powder Company

SESSION "F"—COST AND PROFIT

Thursday, November 10
1:30 P.M.—4:00 P.M.
Moderator: James T. O'Reilly
Ford Motor Company

AUTOMATION AND "MAKE OR BUY"
By: Lee S. Garretson, and
Tom E. Nadeau
Ford Motor Company

SHORT RUNS
By: D. H. Naffziger
Delco-Remy Division, GMC

ADVANCES IN IMPREGNATION MATERIALS AND TECHNIQUES
By: George J. Caudron
American Metaseal of Detroit

SESSION "G"—QUALITY CONTROL

Friday, November 11
9:30 A.M.—12 Noon
Moderator: Clarence Tice
Delco-Remy Div., GMC

QUALITY EVALUATION —TECHNIQUES AND PROCEDURES
By: Arthur Bender
Delco-Remy Div., GMC

EFFECT ON PRODUCT QUALITY OF CAVITY DESIGN, TOOL INSTALLATION AND MACHINE OPERATION
By: Earle Rearwin
Reed-Prentice Div.

CASTING, TRIMMING & HANDLING TECHNIQUES FOR OBTAINING QUALITY DIE CASTINGS
By: Al Sugar
Castmaster Div.—Hydraulic Press Mfg. Co.

REVIEW OF METHODS TO OBTAIN IMPROVED CORROSION RESISTANCE FOR PLATED ZINC DIE CASTINGS
By: Donald R. Millage, and
Edward Romanossaki, and
Dr. Henry Brown

SESSION "H" — VACUUM IN DIE CASTING

Friday, November 11
1:30 P.M.—4:00 P.M.
Moderator: David Morgenstern
Melmor Manufacturing Corporation

VACUUM DIE CASTING—A RESUME OF PROGRESS TO DATE
By: Hiram K. Barton
Hiram Barton Associates
Roughfield Etchingham Sussex
England

SOME EFFECTS OF VACUUM CASTING ON SURFACE FINISH
By: E. L. Simpson
Bell & Howell Company

USE OF VACUUM IN PRODUCTION OF ANODIZABLE QUALITY ALUMINUM DIE CASTINGS
By: Joseph A. Wolteburg
Hamilton Die Cast, Inc.

DCE CONVENTION NOTES

By JOHN L. MacLAREN, Chairman

The foregoing technical program, based on the needs and interest of die casters as ascertained from a poll of the readership of this publication, should register a broad appeal with all segments of the die casting industry. Much credit is due our Congress Chairman and Vice-Chairman, Harry D. Hall and David C. Sallatin, and their committee, for their hard work in assembling such a comprehensive program. Our speakers also are to be congratulated for participating in the program, the most important in the die casting field ever to be presented to this country.

The Exposition and Congress have attracted world-wide attention. A 12-man delegation of British die casters will attend under the auspices of the Zinc Alloy Die Casters' Association. The Japan Die Casting Association will send a team of 35 die casting executives to Detroit. We have yet to hear from the Association in France, Germany and Italy, but expect substantial representation from these countries. Delegates will also be coming from the Middle East and Latin America.

We are confident the die casters of the U.S. and Canada will similarly appreciate the importance of the Congress' technical coverage, and we look forward to a record-breaking attendance.

—— DCE ——

WHAT WILL IT COST FOR YOU TO ATTEND THE SHOW?

1. **EXPOSITION**—There will be no charge for attendance at the Die Casting Exposition at the Detroit Artillery Armory. Buses will take you from downtown Detroit to the Armory and back for a nominal charge. There is ample space at the Armory and Rates are reasonable. A rapid registration form, mailed to members of the Society, and Executives, Buyers, Designers and Production personnel in the die casting industry, will simplify registration and minimize the congestion problem common in many shows.
2. **CONGRESS**—The Technical Congress, consisting of approximately thirty first-class papers, will be held at the Armory in an area adjacent to the Exposition. At the end of each of the eight sessions, copies of the papers presented at that session will be distributed to those attending. Also, after the Congress, a bound volume of all Congress papers will be given to those who register. Registration fee for the Congress will be $12.00 for SDCE members, $15.00 for non-members.
3. **BANQUET**—The Exposition Banquet will be held at the Veterans Memorial Building in Detroit on Thursday evening, November 10th. Dress is optional. Cocktail hour will start at 6:30 P.M., and the banquet will begin at 8:00 P.M. A distinguished speaker schedule, musical entertainment and a performance by Art Briese, Arkansas humorist, are features of the program. Dinner tickets are $10.00 each.
4. **LADIES ACTIVITIES**—A Comprehensive daytime program for the ladies, running Tuesday through Thursday, November 8-10, will be publicized through direct mail. Registration may either be arranged in advance or at the Show Information Desk at the Sheraton-Cadillac (headquarters) Hotel. Charges will depend on the activities selected.

NEWS of the INDUSTRY

METAL CONSUMPTION

Zinc Industry

Consumption of slab zinc in 1960 is expected to be about 15-17 per cent higher than the approximately 940,000 short tons of 1959, the Business and Defense Services Administration, U.S. Department of Commerce, reports. Galvanized steel mill products, particularly sheet and strip are held to account for the largest part of this increase.

Indispensable to the industrial strength of the United States, zinc is used in some form by practically every branch of industry and in production of a very wide range of military and essential civilian goods.

Zinc's continued importance in our economy is pointed up by the tonnages required for the production of galvanized steel and steel products, zinc base alloys (die castings), and brass products.

An increase of some 40 per cent in consumption of zinc for 1960 over the 1959 rate of 340,000 tons is anticipated. Zinc base alloys for die castings should consume 6-7 per cent more zinc this year in view of increased automobile production. Brass mill requirements for zinc are expected to increase about 3 to 4 per cent.

—— DCE ——

Magnesium Industry

The consumption of magnesium in 1960 should approximate the 1959 total of some 51,000 tons, including recovery from scrap.

The industry produces mainly primary and secondary ingot, sheet, extrusions, forgings, castings, and powder. Commercial uses of magnesium are about the same as last year but the industry is aiming for new applications in the automotive field, where any significant developments could lead to increased usage, particularly in the form of die castings.

Shipments of primary magnesium increased 18 per cent in the first four months of 1960 over the like period a year ago. Primary production increased 84 per cent over last year. Both production and shipments rose after the first few months of last year and since have held close to the levels of the last half of 1959. The 1960 shipments exceeded production, but at a lower rate than in 1959.

—— DCE ——

Aluminum Industry

Aluminum shipments to consuming industries this year should about equal or slightly exceed those of the peak year 1959—5 billion pounds. The shipments last year included a substantial amount of consumer inventory accumulation.

Third quarter shipments are likely to equal the rate of the first two quarters but shipments are expected to show a pickup in the last quarter, as construction and building are expected to improve and production of appliances probably will be up.

Increasing amounts of aluminum will be used in the 1961 model cars. Some new compact cars will have aluminum engines, and other new uses are anticipated.

Some rebuilding of consumer inventories, likely reduced in earlier months, should be evidenced, in addition to increased consumption.

The aluminum industry produces pig, ingot, and semi-fabricated forms—sheet, plate, foil, rod, bar, wire, cable, extruded shapes, tube, powder, forgings and castings. These products are used by over 25,000 plants in making thousands of end-items.

Primary production for 1960 is expected to be about 4.2 billion pounds, against 3.9 billion pounds in 1959.

First quarter shipments are broken down for comparison in the following table:

Shipments of Aluminum Castings

(Thousands of Pounds)

Item	Year 1959	January-March 1959	January-March 1960	Per cent change
Total castings	784.5	210,628	212,162	+ 0.7
Sand	142.7	34,452	36,012	+ 4.5
Permanent mold	271.5	77,236	68,395	—11.5
Die	369.1	98,909	107,440	+ 8.6
Other*	----	-----	------	--

*Not publishable because standard error too high. Source: Bureau of the Census.

THE ART COLUMN

■ CONTINUED FROM PAGE 16

Over the entire experimentation the effects of gas and oxides in the casting metal have been observed. We found that aluminum containing gas gave greater porosity when cast under vacuum than when cast without vacuum.

Number of Conclusions Reached

As a result of this work, the following conclusions have been reached: Vacuum in order to be effective must be present in the cavity during the entire filling cycle.

Vacuum in order to be fully effective must never result in a back pressure.

Venting, even under vacuum, must be independent for each cavity.

Metal when cast under vacuum must be free of gas and oxides. This proved to be extremely important.

The timing of the vacuum application is of utmost importance. The effective increments of time are milliseconds.

In order to be effective and eliminate destructive variables the entire die area should be sealed during the injection cycle. This also includes the cold chamber area.

Vacuum Must Be Constant

In order to completely eliminate the variables the connected vacuum reservoir or accumulator must be at least five times the volume of the cavity and must be so connected that the cavity and vent vacuum and the reservoir vacuum remain nearly constant during the entire filling cycle.

The gate velocities were increased under sustained vacuum and the cavity filling times were decreased. It was observed that the filling pattern also changed. Conclusive tables were not developed.

Several Observations Inconclusive

Several observations were made from which no conclusions have been reached. The metal action in the cold chamber differs under vacuum; it tends to climb both the side walls and the ends.

The thermal action of the metal appears to differ, especially in tubes and metal passage areas. This causes freeze-offs and erosion.

The final conclusion, do not attempt to "beat time" by the mere application of vacuum in the near vicinity of your casting cavity. Instrumentation proves that to be effective, vacuum must be present during the entire filling cycle without any variation in order to accomplish consistent benefits.

********** PEOPLE IN DIE CASTING **********

M. W. Saxman Resigns Latrobe Steel Presidency; J. E. Workman Successor

• **M. W. Saxman** has resigned as president of Latrobe Steel Company but will continue as chairman of the board. Executive vice president **J. E. Workman** has been elevated to the presidency.

Mr. Saxman's retirement as chief executive officer culminates 36 years of service at Latrobe. He joined the company in 1924 as superintendent of the

J. E. WORKMAN

W. G. STEWART

Cold Finishing Department, and in 1935 became vice president in charge of sales. He was elected president in 1940 and board chairman last April.

• **John Wandrisco,** assistant to the president, has been promoted to vice president in charge of corporate planning. He is a member of the American Iron and Steel Institute, American Marketing Association and the American Management Association.

— DCE —

• **William G. Stewart,** president of Universal-Cyclops Steel Corp., has been elected a member of the board of directors of Strategic Materials Corp. Mr. Stewart has been with Universal-Cyclops since 1929. This company is one of the leading producers of stainless steels, tool steels, high temperature metals, and refractory and reactive

E. E. HALL

R. J. DVORAK

metals. Its subsidiary, Empire-Reeves Corp., produces carbon, electrical, and galvanized steel sheet and galvanized fabricated products.

— DCE —

• **John L. Stewart** has been appointed general sales manager of Universal-Cyclops Steel Corp. Edward E. Hall has been promoted to assistant general sales manager. Mr. Stewart, who started as a sales trainee in 1946, has been district sales manager in Chicago. Mr. Hall was manager of technical services.

— DCE —

• Appointment of three process engineers, all specialists in vibratory finishing, is announced by Pangborn Corporation. **William E. Brandt, Jr.** is assigned to the Hagerstown office, **Barry L. Selack** to Cleveland and **John G. Weber** to Milwaukee.

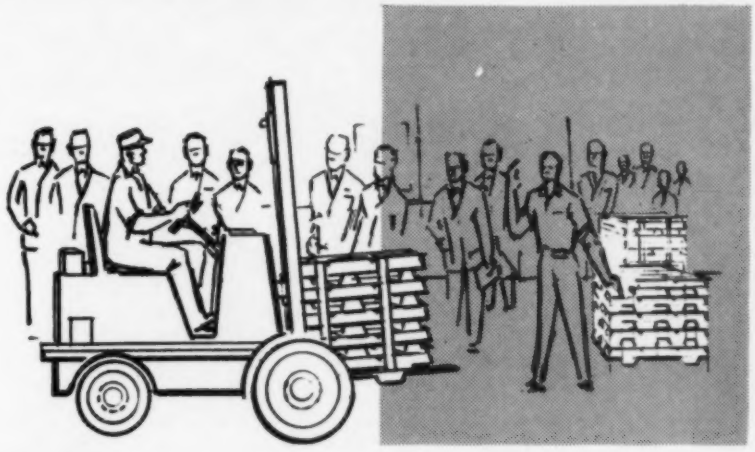
— DCE —

• **Richard J. Dvorak** has been appointed sales engineer for WaiMet Alloys Company, Dearborn, Mich. He previously was associated with the Chrysler Corporation as a research metallurgical engineer in charge of foundry operations.

BRING A FRIEND

NOV. 8-11

To The EXPOSITION



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CIRCLE 14 READERS SERVICE CARD

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Detroit 35, Michigan

Diamond 1-8873

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United Mineral & Chemical Corp.

A complete line of belts, sheets, rolls and discs on cloth, paper and fiber backings.

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1—Cleveland 400 ton Aluminum, and 1 Zinc
1—Kux B.H.—18 Zinc 300 ton
3—Lake Erie 300 ton Zinc, late models fully hydraulic
2—Reed-Prentice #1½ Zinc and 1 Aluminum 225 ton
2—Lester 600 ton Aluminum, 1949
1—B. & T. 80 ton Zinc
3—A. B. C. air operated with four 1" diameter tie bars, 1957
several Kux BH-12 (hydraulic) and BA-12 (air operated) 80 ton
1—"Standard" Detroit 500 ton Zinc, modern and very fast

2—Lindberg induction dual-chamber furnaces for Aluminum. 30 KW. (220 volts) practically new
4—Ajax induction furnaces 20 KW. (220 volts)

All our machines are completely rebuilt by experts, and tested under power.

Thirty days operation guarantee.

We will rebuild and modernize your older machines, or accept them in trade. Our machines may be leased or purchased at approximately half new cost, and they will perform as well, as fast, and as long as any new machine.

DIECASTERS' EQUIPMENT DIVISION
MAGNESIUM INDUSTRIES, INC.

1313 Kalamazoo St., South Haven, Michigan Tel. 1163

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2. **Proven ability to stand up better in zinc, aluminum, and magnesium die casting.**
3. **Can be ground from the solid into CORE PINS without rehardening after grinding.**
4. **Complete stock of all fractional & letter sizes 1/16"—1".**

PROSPECT DIE & MOLD COMPANY
26650 Sherwood Center Line, Michigan
Box 257 SLocum 7-7747

EJECTOR PINS CORE PINS
CUTTER BLANKS
WATER COOLED SPRUE SPREADERS
AND NOZZLES (BUSHINGS)

Send for our complete Catalog prices and dimensions listed

CIRCLE 16 READERS SERVICE CARD

COLUMBIA TOOL STEELS

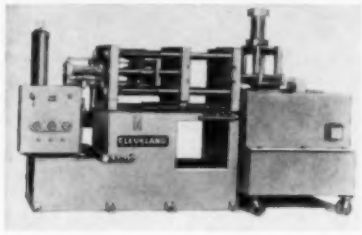
ALCODIE (type H12)—Aluminum die casting die steel keeps your production right side up

Product of Skilled
American Workmen

********** NEW IDEAS-NEW PRODUCTS **********

New Model 100 Cleveland Die Casting Machine

▲ An entirely new design of their Model 100 Cleveland Die Casting Machine is being offered by Cleveland Automatic Machine Co., Cincinnati, Ohio. The machine has strain gage test locking pres-



sure of better than 100 tons. It is available as a standard, or fully automated, hot chamber machine; as a standard cold chamber machine; or as a cold chamber machine equipped with the Morton system of vacuum die evacuation, with or without automatic ladling.

CIRCLE 18 READERS SERVICE CARD

— DCE —

New Aluminum Rocker Arm Cuts Engine Production Cost

▲ A newly perfected aluminum rocker arm, developed in four years by Aluminum Company of America, is the latest application of the light metal to cut engine production costs. Sixteen rocker arms, about the size and weight of small suitcase handles, open and close intake and exhaust valves in an engine's eight cylinders to a split-second beat. Alcoa predicts quick acceptance and widespread use of the cast aluminum replacement for the traditional and heavy iron arm because of less wear.

CIRCLE 19 READERS SERVICE CARD

— DCE —

Wernicki Shot System On NoBar Machines

▲ The Wernicki shot system will be available as standard equipment on the NOBAR DIE CASTING MACHINE.

Close coupled shot systems can be purchased for existing die casting machines and licenses to use this shot system on new equipment are also available.

Address all inquiries to WERCO ENGINEERING CO., 946 13th Avenue, Grafton, Wisconsin.

CIRCLE 20 READERS SERVICE CARD

— DCE —

Hevi-Duty Co. Offers New Line of Electric Furnaces

▲ A complete new line of double chamber dry hearth aluminum melting and holding furnaces is announced by Hevi-Duty Electric Company, now a division of Basic Products Corporation, 2040 W. Wisconsin Ave., Milwaukee 1, Wisc.

The new line consists of three furnace types designed for use in aluminum sand casting, die casting and permanent mold plants. All three furnaces are of single unit construction with individual melting and holding chambers.

Either gas, oil or combination fuel-fired, the furnaces feature separate fir-

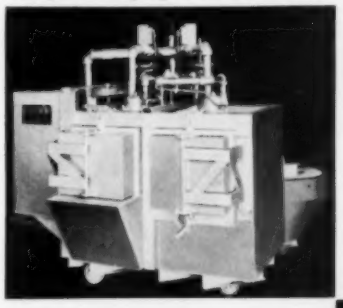
CONTINUED ON PAGE 30 ■

HAVE YOU SEEN
NOV. 8-11
TECHNICAL PROGRAM?

KOZMA

NEW! RADIANT ALUMINUM
MELTING and HOLDING FURNACES
UNEQUALLED FOR LOW POROSITY ALUMINUM CASTINGS

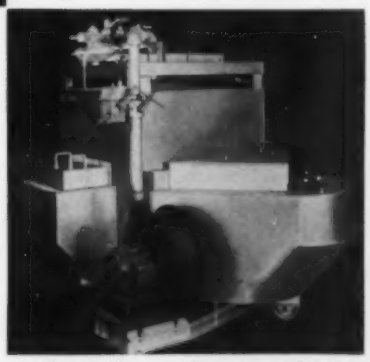
Model RSHCH Melting Furnaces feature the Kozma exclusive "Pre-Temp" charging and sub-surface metal flow virtually eliminating hydrogen pick-up and oxide inclusions, keeping metal at high purity level.



Radiant panel firing provides faster, more uniform heat distribution, eliminates flame impingement and reduces fuel costs.

Model RSHCH Furnaces range in capacity from 300 to 2,000 lbs. per hour with design variations to meet your requirements.

MODEL RH
HOLDING FURNACES



are specially designed for use with vacuum or non-vacuum aluminum die casting machines. Roller bearing wheels and a unique dipwell permit integral installation as part of the die casting machine. Bath capacities and dipwell design to meet your requirements.

Kozma Melting and Holding Furnaces are being specified by both die casting machine manufacturers and aluminum producers where highest quality metal is a "must."

There is a Kozma Radiant Aluminum Furnace for every melting and holding need. Write today for complete information.

Also available from Kozma—
New Automatic Ladling Unit
Low Cost — Fast — Accurate

J. A. KOZMA Company
2471 WYOMING
DEARBORN, MICHIGAN

INDUSTRIAL PROCESSING FURNACES
SINCE 1928

CIRCLE 21 READERS SERVICE CARD

■ CONTINUED FROM PAGE 29

ing systems in each chamber to assure rapid melting in one chamber and correct holding temperature in the other.

CIRCLE 22 READERS SERVICE CARD
— DCE —

New Production Recorder Introduced by Keinath Co.

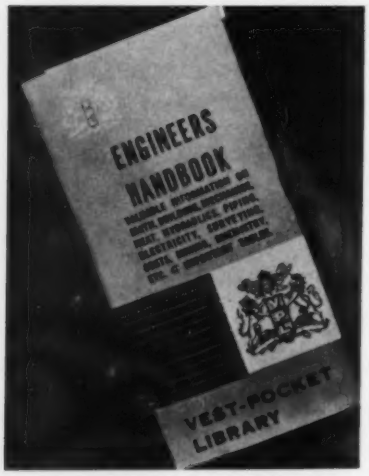
▲ The K-logger, a new type of multiple recorder and annunciator has been introduced by the Keinath Instrument Company, Columbus, Ohio. The unit records and displays, on one chart, the production rates of each of a number of machines or processes, minute by minute, throughout a shift or a day. It also relates production rate to the temperature, amperage, speed, or other significant process variables existing at the time.

CIRCLE 23 READERS SERVICE CARD
— DCE —

TECHNICAL LITERATURE

Engineer's Vest Pocket Book Is Published

■ A vest pocket book containing information an engineer needs readily at hand has been published by Ottenheimer Publishers, Inc. to retail at 90 cents. It covers such varied topics as formula for the Binomial Theorem, properties of structural steel, strength



of gear teeth, thermal stress, resistance, verniers, cost estimating, properties of minerals, etc.

Some 250 main items and 47 important charts are provided in the 192 page book (2⅝ x 5½). It is indexed alphabetically and has 12 marginal indexed headings: Mathematics, building, mechanics, heat, hydraulics, pioes, electricity, surveying, costing, mining, chemistry, and miscellaneous data.

CIRCLE 24 READERS SERVICE CARD
— DCE —

Columbia Eng. Plastic Mold, Die Cast Die Bases' Catalog

■ Prices and design specifications for standard and special plastic mold and die cast die bases are given in the new 1960 illustrated catalog of Columbia Engineering Co. Also listed are the various steels and machining services available for plastic injection, compression and stripper mold bases and for die cast die bases.

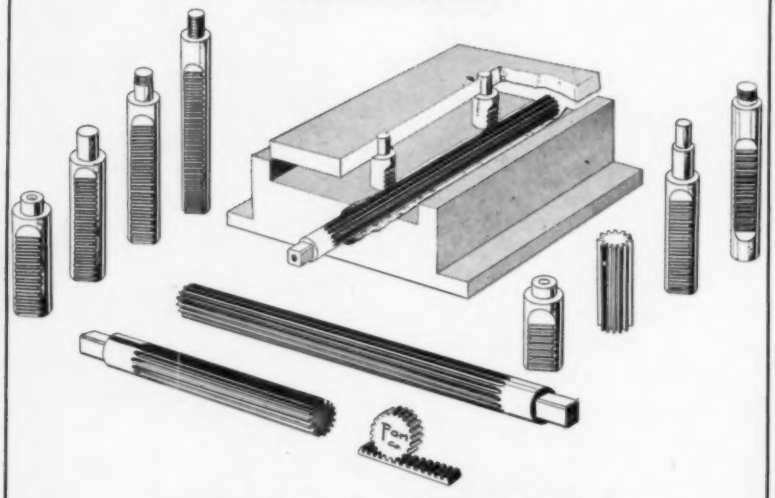
CIRCLE 25 READERS SERVICE CARD
— DCE —

New Tumb-L-Matic Catalog Sheet on Its LS Type Line

■ A new catalog sheet describing Tumb-L-Matic, Inc.'s line of LS Type barrel tumbling equipment for finishing and definning plastic or metal parts by the dry process, to eliminate multiple operations, is available free from the Stamford, Conn. concern.

CIRCLE 26 READERS SERVICE CARD

REDUCE COSTS WITH
PEERLESS * "FLAME-A-LOY"
PINIONS & RACKS
FOR
DIE CASTING MOLDS PERMANENT MOLDS
PLASTIC MOLDS



☆ STANDARDIZED SIZES MADE FROM SPECIAL TOUGHENED ALLOY STEELS
☆ ACCURATE CUT RACKS TO MATCH PINIONS FOR LONGER WEAR LIFE
☆ CATALOG No. 167A AVAILABLE TO USERS

— ESTABLISHED 1921 —

PEERLESS GEAR & MACHINE CO. INC.
W. GENEVA AVE.
DUNKIRK, OHIO
Phone: 3101

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CIRCLE 27 READERS SERVICE CARD

********** NEW IDEAS-NEW PRODUCTS **********

Six New Metal Finishing Processes Announced By Allied Research Products

Six new finishing processes have been added to the line of Allied Research Products, 4004 E. Monument St., Baltimore 5, Md.

Three of these new formulations of this manufacturer of metal finishing processes and equipment are Iridite chromate conversion coatings for providing corrosion protection, paint base protection and final finishing of nonferrous metals. Two are new brightening addition agents for zinc plating baths. One is a new addition agent for copper plating solutions.

— DCE —

Triangle Industries, Inc. Acquired by Greenleaf

Greenleaf Corporation, Pittsburgh, has acquired Triangle Industries, Inc., Saegertown, Pa., manufacturer of specialty tools, gages, and other machine tool items. C. N. Brant, who founded the Saegertown operation five years ago, will continue as general plant manager.

Walter J. Greenleaf, president of the Pittsburgh concern, said the plant will produce specialized tooling for Greenleaf sales outlets. It will also manufacture standard tool holders, milling cutters and other items in the company's product line. The Saegertown plant will also offer engineering services for the development and design of tooling for specialized machine tools.

— DCE —

COME
NOV. 8 - 11
TO THE SHOW—
SEE WHAT'S NEW!

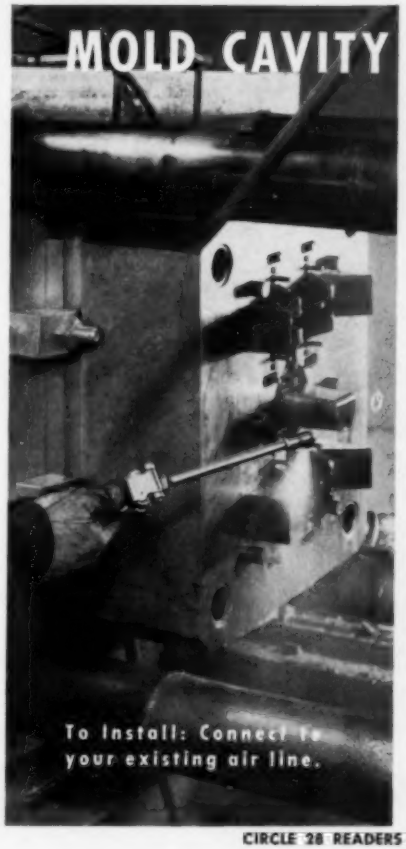
Metal Salesmen's Auto Mileage Jumps in 1960

Average mileage for metal products salesmen driving autos on company business rose to 2,105 miles per month for the first four months of 1960, vs. 2,024 for the like period of 1959.

This was disclosed by A. J. Schoen, president of Wheels, Inc., Chicago, a leading auto fleet leasing firm, who revealed the results of a national survey covering all industries.

The 12-month average for the metals industries for 1959 was 23,800 miles and the projected average for 1960 is approximately 25,000 miles, Schoen said.

"Increased competition for sales is the major reason for the upsurge in miles being driven by salesmen in making their calls," Schoen said. "Salesmen report that their customers are tougher on price, are making increased demands for speedier deliveries, and are more exacting as to the quality of the merchandise they order."



SURFACES
CLEANED
COOLED *and*
LUBRICATED
in one operation!

The PIERCE-WALLER 2-stage spray gun, with its adjustable spray density, delivers a cavity cleaning and cooling blast of air, and deposits a controlled spray mist in the mold . . . in one simple operation!

The P-W AIR LUBE SYSTEM consists of a 1-trigger, 2-stage gun, and a pressurized lubricant tank engineered to automatically agitate the lubricant release-agent before it is applied to the mold cavity.

. . . assures safe, clean, efficient conditioning of the cavity surfaces . . . insures the ejection of usable die castings in either small, medium or large production lots . . . extends mold life.

For immediate information concerning price and delivery write:

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COMPANY
KETTERING P. O. BOX 2121A
DAYTON 9, OHIO

CIRCLE 28 READERS SERVICE CARD

RENELL, INC. Designers and Builders
of
DIE CAST DIES - DIE CAST TRIM DIES - JIGS & FIXTURES - PLASTIC TOOLS & DIES
KELLERING - HOBBING - STEEL ENGRAVERS
ANDREW HERKOMMER
8939 HUBBEL AVE. BRoadway 3-0023 DETROIT 28, MICHIGAN

CIRCLE 29 READERS SERVICE CARD

Indiana Chapter 25 Plans Plant Tour

A tour of the die cast facilities of the Delco-Remy plant of General Motors Corp. at Anderson, Indiana will highlight the October 13 dinner meeting of Indiana Chapter 25 of the Society of Die Casting Engineers. The meeting is scheduled for 7 p.m.

The tour will feature the automatic die casting of both zinc and aluminum on large machines.

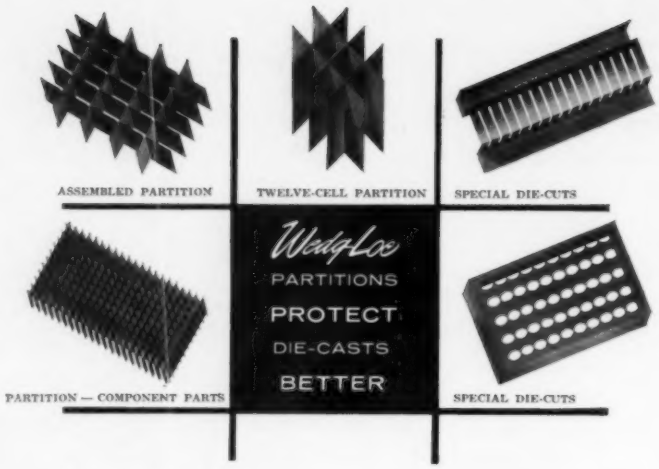
D. I. Weatherford, plant superintendent for the host company, will give a short talk on die casting techniques at Delco.

Due to conditions in handling of a large group touring an operating plant, the tour is to be restricted to paid up members in good standing of the Indiana Chapter only.

S. D. C. E. EXPOSITION

NOV. 8-11

PLAN TO ATTEND THE BANQUET



WEDG-LOC CARDBOARD PARTITIONS, DIE-CUTS, AND PADS protect polished and plated die-cast parts from scratching. They reduce packaging time, and assure accurate count.

TELL US YOUR NEEDS

W. J. Bradford PAPER COMPANY SINCE 1924

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Searching for

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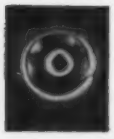
Die castings?
Dies & Machines?
Air and Odor?

LONGER LIFE . .



from Die Plungers, Cylinders & Sleeves?

TRY:- **LO-SMOKE** Die Casting Lubes

Send for samples & technical data.

ALDRIDGE INDUSTRIAL OILS, Inc.

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NONFERROUS METAL ALLOYS CORP.

Mfrs.
of

Zinc Base Die Cast Alloys
No. 2
No. 3
No. 5
Zinc Ball Anodes

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DETROIT 12
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CIRCLE 32 READERS SERVICE CARD

Belleville Die Shop, Inc.

ROMULUS, MICHIGAN
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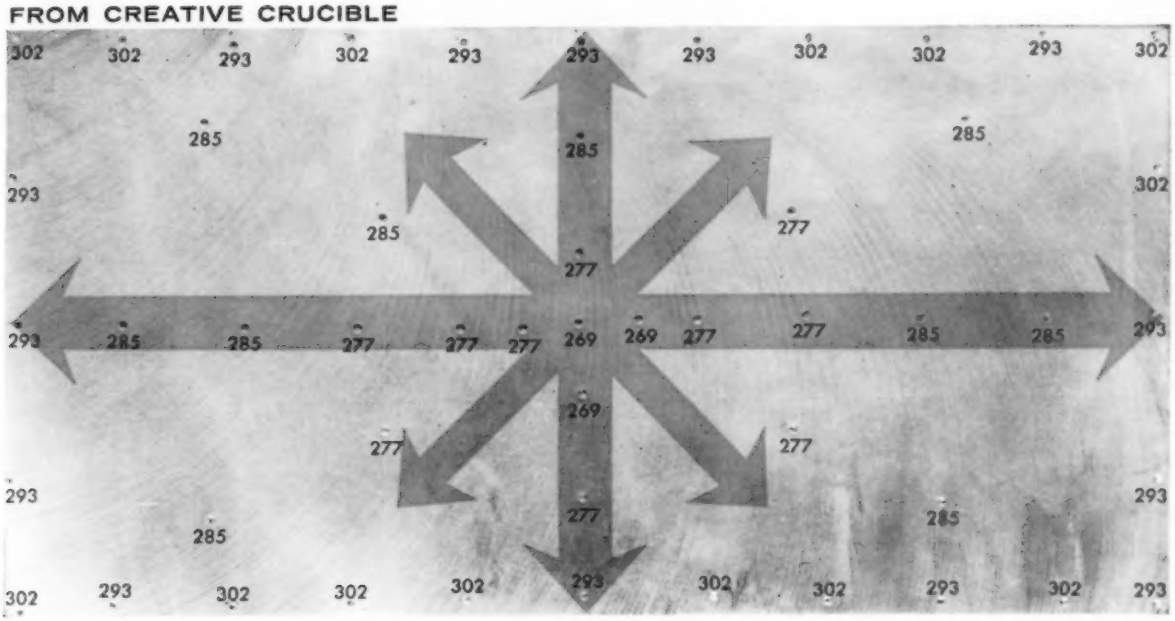
Die Cast Dies
Plastic and Rubber Molds
Pocket Milling Specialists in Mold Bases and Cavity Retainer Sets

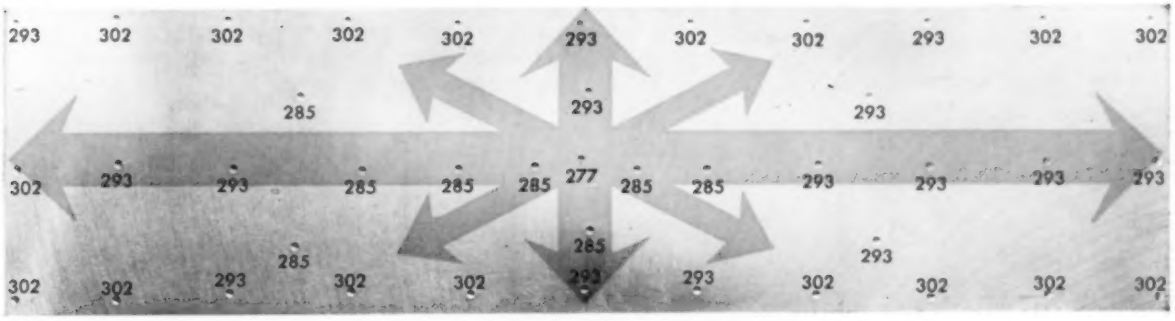
DICK WHICHELLO

CIRCLE 33 READERS SERVICE CARD

FROM CREATIVE CRUCIBLE



20" x 10"



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CSM 2

with positive, high hardenability

Now you can make larger plastic molds and die casting dies—for longer runs—and get better finishes!

Notice the small hardness gradient—across the surface and from surface to center—of these typical blocks of prehardened CSM 2. This small gradient indicates the more uniform hardness of CSM 2—and assures you of at least 5 major benefits:

- more uniform polish from top to bottom of cavity
- greater resistance to washing at center or bottom of cavity
- more positive shut-off surface—particularly in internally landed molds and dies
- more uniform machining characteristics from top to center of cavity
- elimination of heat treatment of most plastic injection molds and zinc die casting dies in sections up to 14" to 15" thick.

Complete details on Crucible CSM 2—either prehardened or annealed—are readily available through local Crucible steel service centers. For data, call the center nearest you or write: *Crucible Steel Company of America, Dept. TG27, Pittsburgh 30, Pa.*

CRUCIBLE STEEL COMPANY OF AMERICA

CIRCLE 38 READERS SERVICE CARD

DIE CASTING ENGINEER

OFFICIAL PUBLICATION OF
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